MULTI-ATTITUDINAL APPROACHES OF COLOUR PERCEPTION: CONSTRUING ELEVEN BASIC COLOURS BY REPERTORY GRID TECHNIQUE

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submitted by **SAADET AKBAY** in partial fulfillment of the requirements for the degree of **Doctor of Philosophy in Industrial Design Department, Middle East Technical University** by,

Prof. Dr. Canan Özgen _____
Dean, Graduate School of **Natural and Applied Sciences**

Assoc. Prof. Dr. Gülay Hasdoğan _____
Head of Department, **Industrial Design**

Assist. Prof. Dr. Naz Börekçi _____
Supervisor, **Industrial Design Dept., METU**

Examining Committee Members:

Assoc. Prof. Dr. Bahar Şener Pedgley _____
Industrial Design Dept., METU

Assist. Prof. Dr. Naz Börekçi _____
Industrial Design Dept., METU

Prof. Dr. Gülay Hasdoğan _____
Industrial Design Dept., METU

Assist. Prof. Dr. Nilgün Olguntürk _____
Interior Architecture and Environmental Design Dept., Bilkent University

Assist. Prof. Dr. Ufuk Demirbaş _____
Interior Architecture Dept., Çankaya University

Date: *25.01.2013*

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Name, Last name: **Saadet AKBAY**

Signature:

ABSTRACT

MULTI-ATTITUDINAL APPROACHES OF COLOUR PERCEPTION: CONSTRUING ELEVEN BASIC COLOURS BY REPERTORY GRID TECHNIQUE

Akbay, Saadet
Ph.D., Department of Industrial Design
Supervisor: Assist. Prof. Dr. Naz Börekçi

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Colour is a basic aspect of perception and the perception of colour varies from individual to individual. This indicates that the perception of colours mean different semantics in various contexts to different individuals. Therefore, these differences in perception forms to behave in different attitudes towards colours among individuals and it is likely to achieve different attitudinal responses to colours from individuals. Relying on the effects of colours on individuals, the initial interest of this thesis is to explore the attitudinal approaches of individuals to colours.

This thesis is first and foremost exploratory in nature. This thesis intended as a first step towards exploring the ways in which the individuals think of, construe and give meaning to colours in their own words. The subjective approach proposed in terms of this thesis is based on the underlying philosophy behind Personal Construct Theory (PCT). In order to elicit the individuals' ways of construing and giving meaning to colours in their own words, an experiment was conducted with the utilisation of the Repertory Grid Technique (RGT). Sixty undergraduate students of Middle East Technical University (METU) Faculty of Architecture were voluntarily participated in the experiment. As a stimuli, eleven basic colours which were black, grey, white, yellow, orange, red, pink, purple, brown, blue and green were utilised. For the second step, this thesis intended investigating the structure and interrelations between the elicited attitudes of individuals and eleven basic colours.

As a result of the experiment, 60 repertory grids were elicited and were analysed by using the qualitative and quantitative applications of content analysis. The resulted data afterwards were analysed by using multivariate statistical analysis methods. The overall results of this research can support certain information for further scientific investigations on colour perception and colour psychology. Additionally, the results of this research can help and guide designers to attain objective understandings about the individuals' attitudes to colours. This can contribute to designers as a practical worthwhile during colour design and colour planning in their products and services.

Keywords: Colour Perception, Basic Colour Terms, Colour Psychology, Repertory Grid Technique

ÖZ

RENK ALGISININ ÇOKLU TUTUMSAL YAKLAŞIMLARI: REPERTUAR ÇİZELGESİ TEKNİĞİ İLE ON BİR TEMEL RENGİN YORUMLANMASI

Akbay, Saadet
Doktora, Endüstri Ürünleri Tasarımı Bölümü
Tez Yöneticisi: Yrd. Doç. Dr. Naz Börekçi

Ocak 2013, 238 sayfa

Renk algının temel bir öğesidir ve renk algısı bireyler arasında farklılık göstermektedir. Rengin bireylerce farklı algılanması, bu durumun çeşitli bağlamlarda, farklı bireylerde farklı anlamlar ifade ettiğini gösterir. Bu sebeple, renk algısındaki bu farklılıkların; bireyler arasında, farklı tutumlar yaratması ile bireylerden renklere karşı farklı tepkiler edinmek mümkündür. Renklerin kişiler üzerindeki etkisini esas alarak, bu tezin birincil hedefi bireylerin renkler üzerindeki tutumsal yaklaşımlarını keşfetmektir.

Bu tez öncelikli olarak keşif niteliğindedir. Bu tez ilk olarak, bireylerin kendi tanımları ile renkleri ne şekilde düşündüklerini, yorumladıklarını ve anlamlandırdıklarını keşfetmeyi amaçlamıştır. Bu tezde öngörülen öznel yaklaşım, Kişisel Kurgu Teorisi (KKT) temellerinde yatan fikir esaslarına dayandırılmaktadır. Bireylerin kendi tanımları ile ne şekilde renkleri yorumladıklarını ve anlamlandırdıklarını açığa çıkarmak amacıyla, Repertuar Çizelgesi Tekniği'nden (RÇT) faydalanılarak bir deney gerçekleştirilmiştir. Bu deneye Orta Doğu Teknik Üniversitesi (ODTÜ) Mimarlık Fakültesi lisans öğrencilerinden altmış gönüllü katılmıştır. On bir temel renk olan siyah, gri, beyaz, sarı, turuncu, kırmızı, pembe, mor, kahverengi, mavi ve yeşil uyaran olarak kullanılmıştır. İkinci adımda bu tez; bireylerin açığa çıkarılmış tutumları ile on bir temel renkle arasındaki ilişkilendirmeyi ve yapıyı incelemeyi amaçlamıştır.

Bu deneyin sonucu olarak, altmış repertuar çizelgesi elde edilmiş ve bu çizelgeler içerik analizinin nitel ve nicel uygulamalarını kullanarak analiz edilmiştir. Sonuçlandırılan veriler daha sonra çok değişkenli istatistiksel analiz metotları kullanılarak analiz edilmiştir. Bu araştırmanın sonuçları, renk algısı ve renk psikolojisi üzerine yürütülen ileriki bilimsel araştırmalar için bir takım bilgiyi destekleyebilir. Bununla birlikte bu çalışmaya ait sonuçlar tasarımcılara; bireylerin renklerle ilgili tutumları hakkında nesnel anlayışı kazandıracak şekilde yardımıcı ve yol gösterici olabilir. Bu da, tasarımcaların kendi ürünleri ve sundukları hizmetler ile ilgili renk tasarımlarında ve renk planlamasında, tasarımcılara uygulamaya yönelik bir değer olarak katkıda bulunabilir.

Anahtar Kelimeler: Renk Algısı, Temel Renk Terimleri, Renk Psikolojisi, Repertuar Çizelgesi Tekniği

In loving memory of my aunt Namiye Gürdal,
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LIST OF ABBREVIATIONS

ASTM	: American Society for Testing and Materials
CIE	: Commision Internationale D'Eclairge or International Commission on Illumination
DIN	: Deutsches Institute für Normung
METU	: Middle East Technical University
NCS	: Natural Colour System
OSA	: Optical Society of America
OSA-UCS	: Optical Society of America Uniform Color Spaces
PCP	: Personal Construct Psychology
RGT	: Repertory Grid Technique

CHAPTER 1

INTRODUCTION

1.1 Problem Definition

Colour is considered to be a fundamental feature of vision and the most important sensorial phenomenon that gives information about the characteristics and states of the environment and surroundings (Hård, 1969; Porter and Mikellides, 1976; Taft, 1997). Although people achieve the huge amount of information about the environment by seeing colours, perceiving colours differ from seeing colours in terms of its subject context. Seeing colour is the subject of colour vision which is based only on a physiological stimulation of the brain. On the other hand, the perception of colour contains in itself not only all probable associative or connotative and symbolic meaning of colours but also feelings, emotions and psychological reactions. Mahnke (1996) claims that colour is a psychological experience which has subjective occurrences in the perception or sensation of a colour of an individual. He states further that the perception of a colour depends upon physical and physiological aspects of a colour; however, the relationship between the physical input and the individual's responses of that input has psychological components.

Since the perception of colour is widely recognised as a subjective phenomenon and specific for individuals, this subjectivity forms to behave in different attitudes towards perceived colours among individuals. The differences in attitudes of individuals are generally characterised by innate and instinctive experiences; by early childhood learning processes, family, social and cultural norms; and depend on situational factors such as age, gender, race, cultural and educational background, and so on (Lee and Lee, 2006; Şahin Ekici et al., 2006). Beyond them, in relation to the perceivers' associations with colours, every colour connotes a different meaning, evokes an effective response and an emotional association which all have been influenced by perception. These affective responses to colours and emotional states of colours are considered as an essential part of psychology and have been of interest to experimental psychologists and researchers. It has been suggested that different colours have different connotations and meanings for individuals; therefore, it is likely to achieve different emotional responses to colours from individuals. Relying on the effects of colours on individuals, the experiments done and are being done throughout the years question whether all people give reactions to colours in the same way, what the associations, connotations, meanings, and emotions underlying the colours are, and what the relations of these psychological features to the colour dimensions are (Taft, 1997). Although studying differences between individuals, groups of people or cultures are the subjects of differential psychology, colour studies generate their own areas of research, namely colour preference, colour meaning and colour emotion. Colour preference research is based on the ranking order of colours only according to their appeal by addressing the question why one colour is more beautiful, liked or preferred over the other colours (Crozier, 1996). Colour meaning research is based on searching for the semantic variables and connotative meanings of colours and their relations to colour dimensions (Sivik, 1974a). Colour emotion research deals with either discrete approach or dimensional approach of emotions and their relations to single colours and/or colour dimensions (Gao and Xin, 2006, Suk, 2006).

Within this development of colour studies, colour has a growing interest not only in psychology but also in design. The study of colour is considered as an academic discipline in its own right and has direct relations to design as an integral part (Feisner, 2001). The reason for this is that, colour is one of the gears of the visual elements in design and has a strong relationship with the other design

elements. Colour has an essential characteristic in design for the visual communication for presenting identity, meaning or novelty to an object or an idea (Suk, 2006). It also has a vital part in the design, development and conceptualisation processes of products. During these processes, product designers do some assumptions about the expectations about the potential users and consider consumers' need in terms of the attributes of the product's form, functionality, attractiveness, ease-of-use, affordability, recyclability and safety (Hasdoğan, 1996; Demirbilek and Sener, 2003). Colour is as important as these attributes because it has a greater effect on the consumers' perception of a product (Ding, Sun and Zhang, 2011). Suk (2006) claims that, the role of colour in product design is "[…] to improve the efficacy of message [of a product because it convey messages to perceivers] and to increase the likelihood of purchase." (p. 44). Hsiao, Chiu and Chen (2008) state that the colour of products affects the attitudes and behaviours of consumers during their decisions to purchase a product. This is because it carries different semantics and arouses different associations (Suk, 2006). Therefore, colour may be regarded as containing a higher level of subjectivity and personal attitudes including connotative meanings and emotional associations which are evoked by colours. Whatever the content or context of the research that is used to understand the ways of the attitudes, connotations or emotions of individuals towards certain colours are, what is at stake is the measurement of these attributes by utilising the psychometric tests according to what is wanted to be measured.

The most widely used psychometric test in colour meaning and colour emotion studies is the semantic differential devised by Osgood et al. (1957) which provides the subject with a number of colours to be differentiated and a set of bipolar adjectival scales against them. The subject is requested to judge each presented colour in terms of its associations to each bipolar adjectival scale whether it is hard or soft, warm or cool, etc., on a seven-point rating scale (Carroll, 1959). The limitation of the semantic differential in colour studies is that, it basically uses previously established or customarily employed bipolar adjectival scales from earlier studies (Osgood et al, 1957; Hogg, 1962), this approach of research is nomothetic in nature (Fransella et al., 2004, Jankowicz, 2004). This is based on aggregate data collection and analysis and on what Grace, Jackson and McDaniel (2006) describe as a tendency to generalise in order to find general laws of behaviour that apply to everyone which is free of time and context. In other words, nomothetic approach attempts to describe what is true in general and deals with large groups of people rather than a single person or group of persons.

Feisner (2001) states that the perception of colour can vary from individual to individual which is not to say that "[…] the colour will be perceived differently, but that perception will *mean* different things to different people." (p. 5). In accordance with Feisner's (2001) statement, the main argument of this research is that, since the perception of colour varies from individual to individual and is unique for each individual, individuals' personal judgements, connotations, associations, emotions or in general term, their attitudes towards colours should presumably be unique as well. In other words, the attitudes of individuals towards colours should be idiosyncratic and peculiar to an individual and this approach is idiographic in nature. Idiographic is based on what Grace et al. (2006) describe as a tendency to specify the explicit knowledge of a group of people or a single individual in order to investigate individuals in personal and in-depth detail to achieve a unique understanding of them. This approach assumes that individuals are unique rather than the complex combination of universal laws, which is opposed to nomothetic approach of research. Those are the assumptions, subsequently, on which this thesis is based and the initial interest is to elicit the idiosyncratic/personal attitudes of individuals to the perceived colours.

The subjective approach proposed in terms of this thesis is based on the underlying philosophy behind Personal Construct Psychology (hereinafter PCP) which is defined in short as the personal scientist's theory (Fransella and Bannister, 1977). This indicates that every person is his/her own scientist who has his/her own personal ideas, philosophies and theories about the world. In order to make sense of the world around him/her, every person develops hypotheses to make sense of their experiences and behaves accordingly with his/her personally organised system of interpretations of the experienced events. Thus, PCP deals with the ways of these organised interpretations of the

experiences and it is argued that they are interconnected in people's personal construct systems. In order to explore the structure and content of personal construct systems, the Repertory Grid Technique (RGT) is developed as a method which is considered as the practical application and the methodological component of PCP. The RGT is a structured interview technique that aims at exploring the ways in which individuals construct the world around them. The technique is based on asking questions regarding the alikeness and/or differences between stimuli. The individuals' statements that define the reasons of the stimuli being alike or different are their personal constructs. A construct thus is defined as individuals' way of distinguishing similarity from difference and this similarity-difference judgement of stimuli is bipolar in nature (Beail, 1985; Bannister and Fransella, 1986; Osbourn, 1988).

Since the RGT has been widely applied in clinical psychology and psychotherapy, it is adopted by various fields of research in order to explore the affective qualities and to examine the similarities and the differences of consumers/users' perceptions of products and services in the area of human computer interaction (HCI), market research and consumer research (Hassenzahl and Wessler, 2000; Tomico et al., 2009). Insomuch as very little research is available on colour literature that the RGT is applied or adapted (Akbay and Ertez Ural, 2008). It is thought that this technique can address the idiographic approach of this thesis in the sense of eliciting the idiosyncratic/personal attitudes of individuals towards the perceived colours. The elicitations of these idiosyncratic/personal attitudes towards colours depend on asking the individuals to describe their ways of construing and giving meaning to colours in their own words. It is believed that, the elicited bipolar attitudes that the individuals form in distinguishing between the perceived colours in their own words can provide a rich understanding not only of the colours but also of the individuals' value system about the colours. In this sense, it is also believed that this methodological approach can reveal the individuals' attitudes and/or their relations to the perceived colours. The intention of this thesis is to shed some light on the idiosyncrasy and peculiarity of colour perception which is believed to indicate an area of research that can constitute the basis of a doctoral thesis.

1.2 Contributions to Knowledge

The outcome of this research is intended to contribute to the academic and practical knowledge. The Repertory Grid Technique (RGT) that has been introduced in this research is a systematic and an efficient technique for eliciting qualitatively individuals' idiosyncratic views in relation to perceived colours. The RGT, moreover, embodies possibility to obtain data to be analysed quantitatively with modern statistical methods. What is of great significance of the RGT is that, this technique allows the individuals to create their own semantic differentials in their own words to perceived colours and to give relevant semantic scales to rate the set of colours. It is believed that, the methodology which is implemented in this research contributes a worthwhile approach to the standard methodologies that has been utilised in the studies of colour perception and colour psychology. The utilisation of another methodology from psychological sciences might have developed rather different theories, concepts, and solutions that could be relevant in these academic areas. The obtained semantic scales in this research by eliciting the idiosyncratic views of individuals in their own words to colours can be regarded to be used as an additional complement in colour studies. Supplying these scales to be used as measurement tools in colour studies might undertake interesting results in addition to those of the previous studies on connotative meanings and emotional associations of colours. Subsequently, the findings of this research can suggest certain information for further scientific investigations on colour perception and colour psychology.

The results of this research are believed to have practical contributions to design professionals who make use of colour samples in colour design and colour planning. Colour affects the expression of a product and improves the efficacy of the message that it gives. In accordance, colour plays a prominent role in decision making process in product design; this is because the colour of a product affects the attitudes and behaviours of consumers/users during their decisions to purchase a product. Therefore, designers should think of the consumers/users' needs during the product design

process. The results of this theoretical research thus can shed some light on the ways in which the individuals think of, construe and give meanings to colours. This can help and guide designers to attain objective understandings about the individuals' attitudes towards colours which may in turn contribute to designers as practical worthwhile during colour planning in their products and services.

1.3 Thesis Structure

This thesis is comprised of seven major chapters:

Chapter 1 'Introduction' gives the problem definition, contributions to knowledge and thesis structure.

Chapter 2 'Theoretical Framework of the Research', is based on reviewing the theoretical and empirical foundation for the research. It is composed of six sections. The first section reviews the definitions of colour in different viewpoints. The second section describes three colour dimensions and attributes which are hue, lightness/value, and saturation/chroma. The third section defines the perceptive and psychological colour order systems. The fourth section provides a review of what the basic colour terms are. The fifth section is based on colour psychology which reviews the existing literature on colour meaning and colour emotion by discussing the empirical investigations. Last section gives a brief review on the usage of colour in product design.

Chapter 3 'Methodological Background of the Research', describes the methodological approach proposed in terms of this thesis. The first section of this chapter defines the underlying philosophy on which this proposed approach is based and the second section describes its practical application and methodological component, which is the structured interview technique that this research utilises.

Chapter 4 'The Experiment and Research Method', is based on the detailed explanation of the experimental study in this research, which describes the aim and objectives, research questions, research approach, experimental set-up, apparatuses that are used, the selection and description of the colours that are utilised as stimuli, Ishihara test for colour blindness and the participants who attend the experiment. These are followed by defining the data collection method and its procedure and end with describing the role of the researcher in the experiment.

Chapter 5 and Chapter 6 summarise the analytical procedures and the results of the research. Chapter 5 discusses the analysis procedures and the results of the attitudinal approaches of individuals towards the perceived colours. This chapter is mainly based on analysing the elicited data by using the qualitative and quantitative applications of content analysis procedure. This chapter also describes the data numerically by using the mean and standard deviation statistics and the reliability of the data is assessed in order to explore to what extent the obtained data is consistent.

Chapter 6 discusses the analysis procedures and the results of the structure and interrelations between the elicited attitudes of individuals and the perceived colours. This chapter is based on analysing the data quantitatively with the utilisation of the multivariate statistical analysis methods. This chapter gives the results which are obtained by applying exploratory factor analysis, bivariate correlation, hierarchical cluster analysis and one sample t-test.

Chapter 7 'Conclusion' discusses and appraises the findings of the research in relation to the theoretical backgrounds of the colour studies in the existing literature. This chapter also describes the limitations of the research and suggestions for further investigations.

The resulted data of the research and their full results of the statistical analyses are given in the appendices.

CHAPTER 2

THEORETICAL FRAMEWORK OF THE RESEARCH

2.1 Colour: Definition

People when speak of colours, generally specify the colours of objects by identifying the property of colour that the things possess such as stating the apple is red, the leaves are green, and the sea is blue (Zollinger, 1999). Since everybody knows what the colours that surround them are, i.e. red, green, or blue, they probably leave unanswered the question of what is colour (Taft, 1997). "Is colour a feature of an inherent property of an object? […] Or is colour different wavelength of energy? […] Is colour a characteristic of visible radiant energy or an aspect of visual perception? Is colour a psychological phenomenon? Or is it all of these things [aspects]?" (Taft, 1997, p. 7).

Colour is considered to be a fundamental feature of vision and the most important sensorial phenomenon that gives information about the characteristics and states of the environment and surroundings (Hård, 1969; Porter and Mikellides, 1976; Taft, 1997). Depending on the branch of science, colour is introduced in different points of view.

> The physician thinks of radiation and wavelengths, the chemist of pigments and mixtures of materials, the physiologist of the anatomy of the eye and the working receptors, nerve cells and brain centres. The psychologist thinks of colour as sensory perception and human conditioning, the artist of a palette or the expressive quality of colour. The architect and designer think of a colour as a property and experience of objects and their function in the environment (Bergström, 2008, p. 6).

Although these definitions of colour represent the divergent views and provide all information needed, there would be difficulty in agreeing on what colour is and what is meant by colour. As the origin and the nature of colour goes back as far as the pictorial representations on cave paintings, the debates on the examination of the nature of colour depend on the periods of Ancient Greece (Sharpe, 1974; Zollinger, 1999).

The thinking of colour in Ancient Greece was largely based on the hypothesis of Aristotle (350 B.C.). Aristotle hypothesised that "Whatever is visible is colour and colour is what lies upon what is in its own nature visible." (MacAdam, 1970, p. 2). Aristotle supported his hypothesis further by saying, "[…] sunlight always becomes darkened or less intense in its interactions with objects" (Nassau, 1998, p. 4), thus "[…] what is seen in light is always colour [which are the mixtures of black and white] (Zollinger, 1999) […] without the help of light, colour remains invisible." (MacAdam, 1970, p. 3). Aristotle also believed that "[…] white and the black could be juxtaposed in quantities so minute that (a particle of) either separately would be visible, though their combination […] would be visible; and they could thus have the other colours for resultants." (MacAdam, 1970, p. 6). Although the opposing views on colour were proposed by the early Greek scholars, Aristotle's idea was employed to develop the modern understanding of the science of colour (Sharpe, 1974; Taft, 1997).

The beginning of the science of colour was based on the experiment of Sir Isaac Newton in 1666. He was interested in the physics of colour, i.e. the relationship between light and colour, and the mixtures of colour (Zollinger, 1999; Feisner, 2001). Newton discovered in his experiment that when the sunlight, which is a ray, passed through the triangular glass prism, the ray of light was bent and

refracted. This refraction of the light resulted in an array of colours where each was within a different range of wavelength in the following order; red (the longest wavelength), orange, yellow, green, blue, indigo, and violet (the shortest wavelength) (Feisner, 2001). Newton (1671[1]; as qtd. in Nassau, 1998, p. 5) stated that "[…] Light [white light or sunlight] is a heterogeneous mixture of differently refrangible Rays, and that is a mixture of colours" which is called the visible spectrum. Newton (1730[2]; as qtd. in Nassau, 1998, p. 6) indicated that "[…] For the Rays to speak properly are not coloured. In them is nothing else than a certain Power and Disposition to stir up a Sensation of this or that Colour."

Aristotle's idea and Newton's experiment form the current understanding of the physics of colour which can be briefly defined as without light colour does not exist "[…] because colour is a sensation conveyed through the medium of energy in the form of light radiations within the visible spectrum and without an observer these rays do not, in themselves, constitute colour." (Porter and Mikellides, 1976, p. 78). After Newton's experiment, colour became an important subject for research in physiology. Thomas Young stated in 1802 that "[…] all conceivable colour can be obtained by mixing together a small number, probably three, of colours; these having their origin in the retina of the eye and not in the physics of light." (Zollinger, 1999, p. 7). Besides Young, James Clerk Maxwell and Hermann von Helmholtz clarified the situation of colour vision as well. Their interpretation on colour vision is defined as follows;

> Light entering the eye is absorbed in the retina by two types of photoreceptors: the rod cells and the cone cells. Rods are extremely sensitive to light, enabling people to see in very dim conditions, but cannot differentiate colours. Cones are less sensitive. They are responsible for daylight vision and sensitive to colour (Zollinger, 1999, p. 8).

People's sensations of colour are the result of having three types of cones. These cones respond differently to the light of various wavelengths, i.e. short, middle, and long (Berns, 2000). Porter and Mikellides (1976) stated that "It [colour] is the eye and brain of the observer which interprets the meanings of these [wavelengths] energy messages and perceive them as a sensation of colour." (p. 78). However, in order for colour to become visible there need to be objects or surfaces from where the light of various wavelengths are being reflected. Objects or surfaces have no inherent colours themselves but they have the ability to absorb or reflect the certain wavelengths. For instance; a ripe tomato appears as red because it has the property of absorbing all the wavelengths from the white light except the red component of the light.

Colour sensation is considered as the end product of a highly complex visual process which can be divided into three distinct parts; i. the physical stimulus, ii. the physical response and iii. the psychological sensation (Taft, 1997). Wright (1969) clarified these distinct parts as follows; "[…] the colour sensation of which the observer is aware is a function of the physical quality of the light, the physiological process in retina and brain, and the psychological interpretation of the physiological response." (pp. 30-31).

Although the visual process of colour seemed to depend on the combination of the different views of science that were mentioned, Ewald Hering (1878[3]; as cited in Fridell Anter, 2000) claimed that colour perception must be distinguished from the physical and physiological grounds for perception. Hering (1878; as cited in Taft, 1997) illustrated these differences by giving the example of the green of a leaf as in the following.

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[1] Newton, I. (1671). New theory about light and colours. *Philosophical Transactions of the Royal Society 6,* 3075-3085.

[2] Newton, I. (1730). *Opticks.* (4th ed.). W. Innys, London; reprinted: Dover, New York, 1952.

[3] Hering, E. (1878). *Zur Lehre vom Lichtsinne*. Gerold & Sohn, Wien.

> The man on the street understands the green of a leaf to be a property of the leaf. The green is inherent in the leaf. The physicist […] considers green not to be a property of the leaf albeit of the radiation reflected [into the eye] from the leaf. For the physicist then what is green is the radiation. The physiologist knows that if the radiation reflected from the green leaf hits the centre of the retina the leaf will in fact appear green—but if it fall to the periphery of the retina the same leaf appears grey. […] Thus for the physiologist the green of the leaf is neither a property of the leaf nor of radiation but rather of the physiological processes in the neural pathways. For the psychologist the green leaf is a subjective phenomenon, a conscious content of a definite quality. […] [For the psychologist] the green exists not in the leaf, but rather in the mind of the percipient and as a quality (Taft, 1997, pp. 8-9).

Hering's green leaf example above clears that "[…] the "colours" that physicists [and physiologists] measure are not same kind of the thing as the colours that psychologists study (Green-Armytage, 2006, p. 253). In accordance, depending on the branch of science, the concept of colour has so many different definitions and these definitions represent broadly contradictory views of what colour is (Taft, 1997; Bergström, 2008). The definition of Nassau (1998, p. 3) might summarise the divergent aspects of colour as follows; "Colour is […] part of perception that is carried to us from our surroundings by differences in the wavelength of light, is perceived by the eye, and is interpreted by the brain." What is believed in the scope of this thesis is that colour is a subjective experience, a mental phenomenon and a psychological sensation. Beyond them, what is seen by individuals as colour is the colour itself which appears as it is without referring to physical and/or physiological grounds (Billmeyer and Saltzman, 1966; Taff, 1997; Fridell Anter, 2000). However, in order to talk about colour, its dimensions and attributes should be identified which is discussed in details in the next section.

2.2 Colour Dimensions and Attributes

The term colour is often used the same to describe the colour of light and the colour of object by the ordinary life people, which have in different meanings. When talking about colour, it has to be made quite clear to which of these is being referred. The colour of light, or source colour, "is radiant power at various wavelengths of the visually effective spectrum, which is considered to extend approximately from 380 to 780 nm [visible spectrum]" (Camgöz, 2000, p. 8); whereas the colour of an object, or object colour, as Kaufman (1984[4]; cited in Camgöz, 2000, p. 7) stated "is the colour of light reflected from or transmitted through an object when it is illuminated by a standard light source." (see Section 2.3.1).

Since colour is considered in the sense that what is seen as colour is the colour itself, it is considered as an inherent property of an object, as well. However, the perceived colour, or colour percept, can have different modes of appearance. The nomenclature of the OSA (Optical Society of America) (1943[5]; as cited in Evans, 1959) classifies the various modes of appearance of the colour percepts as aperture, illuminant, illumination, and object modes with surface and volume. Evans (1959) defines these four modes of appearance as follow;

> The "aperture" mode corresponds roughly to the perception of the quality of the light from any area considered as *light* without reference to its source. The "illuminant" and "illumination" modes correspond to the perception of the illumination as distinct from the characteristics of the reflecting surface as seen, i.e. the light falling on the surfaces rather than that reflected. The two "object" modes, "surface" and "volume", correspond to the

[4] Kaufman, J. E. (Ed.). (1984). *IES Lighting Handbook: Reference Volume*. New York: IESNA.

[5] System of Nomenclature. (1943). *Journal of the Optical Society of America, 33.*

perception of the properties of the objects independent of the illumination in which they stand (p. 168).

Although the perceived colour is considered as a property of an object or a surface which varies due to the object or surface mode of appearance such as shape, size, texture, location, viewing conditions, etc., colour has its own attributes of modes of appearance (Fridell Anter, 2000; Shevell, 2003). In the phenomenology of colour appearance, the three dimensions of colour, i.e. hue, lightness/value, and saturation/chroma are called the perceptual or psychological attributes of colour (Shevell, 2003). These perceptual attributes of colour are a subset of all colour percepts corresponding to three dimensions (Taft, 1997), which are described in details as follows.

Hue. The first dimension of colour is hue. It is used to describe the kind of a colour and is considered as the main quality factor by which one colour is differentiated from another (Evans, 1959, Mahnke, 1996). Hue is the essential element that represents the qualitative aspect of a colour and is defined as an "attribute of colours that permits them to be classified as red, yellow, green, blue, or an intermediate between any contiguous pair of these colours." (Kuehni, 2004, p. 41). Since the classification of colours are given by the visible spectrum and physically determined by wavelengths, psychologically they are determined by pigments[6] of the arrangements in a closed ring or a circle which is a colour wheel. The hues that do not exist in the spectrum or colour wheel, can be generated either by mixing lights or pigments in different ratios (Kuehni, 2004; Kuehni and Schwarz, 2008).

Lightness or Value. The second dimension of colour is lightness which refers to the quality that distinguishes a light colour from a dark one (Mahnke, 1996). In other words, it refers to the lightness or darkness of a hue (Feisner, 2001). ASTM E 284[7] (as cited in Berns, 2000) defines lightness as an "attribute by which a perceived colour is judged to be equivalent to one of a series of greys ranging from black to white." (p. 22). Additionally, Evans (1959) defines the term lightness as "the visually apparent reflectance[8] of a surface under a given condition" (p. 119). In other words, the lightness of a pigment can be said that "[…] is a measure of how much light is reflected from its surface." (Mahnke, 1996, p. 85). Lightness can sometimes be confused with brightness however they are separate terms. The CIE (Commission Internationale d'Eclairage) (1987[9]; as cited in Berns, 2000) defines brightness as an "attribute of a visual perception according to which an area appears to emit, or reflect, more or less light" (p. 48). When brightness is used to describe light, it means that it is the intensity of a light source whereas when it is used to describe colour, it means that it refers to a highly saturated hue (Mahnke, 1996) (see Saturation or Chroma). The term *value* which is designated by the Munsell Colour System (see Section 2.3.2), is often used as a synonym of the term *lightness* (Camgöz, 2000).

Saturation or Chroma. The third dimension of colour is saturation which is referred to as the purity, strength, and intensity of a given colour (Mahnke, 1996). The saturation of a given colour is generally described by the words such as pale or deep, weak or strong (Evans, 1959). It is defined as an

[6] Pigments are "natural or artificial colorants that only absorbs but also scatters light on the surface of its molecular aggregates; […] are insoluble in the application medium or the substrate" (Kuehni and Schwarz, 2008, p. 385).

[7] ASTM E 284, Standard Terminology of Appearance. *American Society for Testing and Materials,* West Conshohocken, PA.

[8] Reflectance is defined as "the ratio of the reflected light to the incident light under specified conditions" (Berns, 2000, p. 10). Briefly, reflectance is "[...] a characteristic of the surface for a certain light" (Camgöz, 2000, p. 17).

[9] CIE No. 17.4. (4th ed). (1987). *International Lighting Vocabulary.* (Joint publication IEC/CIE).

"attribute of a visual perception that permits a judgement of the degree to which a chromatic stimulus [i.e. red, blue, yellow, and etc.] differs in appearance from that of an achromatic stimulus [i.e. white, black, and grey], regardless of their brightness." (Kuehni and Schwarz, 2008, p. 386). The term *chroma* was introduced by Munsell Colour System (see Section 2.3.2) and has been widely accepted and used as another name for the term *saturation*. Chroma represents the quantitative aspects of a colour and ASTM E 284 (as qtd. in Kuehni, 2004, p. 42) defines it as an "attribute of colour used to indicate the degree of departure of the colour from grey of the same lightness." In other words, the colours with a single hue and with a single lightness or value can vary in their amount of hue which are said to be varying in their chroma (Berns, 2000). All pure hues (the hues which have no white, black or grey in it) are their full chroma but they can vary in accordance with how much colour, or chromaticness, or chroma, that they contain (Billmeyer and Saltzman, 1966; Feisner, 2001).

While two colours, for instance, have the same hue and the same lightness, they may appear different in chroma; the colours that have the same hue and the same intensity, may appear different in lightness. These three perceptual attributes, i.e. hue, lightness, and chroma, of colour not only are necessary to describe a colour but also make the basis of the colour order systems for defining the qualitative and quantitative aspects of colour.

2.3 Colour Order Systems

People have the ability to distinguish millions of colours, yet they are described with very limited names which also differ culturally (Taft, 1997) (see Section 2.4). In order to prevent the subjectivity of describing colours, the question of how to place the colours that are seen into an orderly and meaningful arrangement has been of interest for many years to scientists and colour theorists (Kuehni, 2004). Billmeyer and Saltzman (1966) claim that, "the orderly description and specification of colour is an essential part of solving problems of talking about colours." (p. 25). Colour order systems, colour models, colour spaces or colour atlases are a way for organising the set of possible colours to solve the problems of communicating about colours in a systematic way (Taft, 1997). Wyszecki and Stiles (1982[10], as qtd. in Kuehni, 2000) define the colour order system as follow;

> A colour order system is a rational method or a plan of ordering and specifying all object colours or all within a limited domain by means of a set of material standards selected and displayed so as to represent adequately the whole set of object colours under consideration (p. 123).

The several colour order systems have been developed according to different principles and for specific purposes. Today a large number of colour order systems are used regularly by colourists, manufacturers, engineers, designers, and etc. according to their purposes. These systems can be divided into three groups such as physical, psychophysical and perceptive. Physical colour systems are based on the principles of additive and subtractive colour mixtures. Additive system is generated by mixing three primary coloured lights red, green, and blue (i.e. RGB) in different quantities which is useful in applications such as a television set, flat panel display or a beamer (Ebner, 2007). Subtractive system can be defined as the superimposing of different light-permeable layers of pigments on each other. The three primary colours, cyan, magenta, and yellow (CMY) are used for dye mixtures in textile production, pigment mixtures for paints and four colour mixtures in ink printing (CMYK) (Ebner, 2007; Bergström, 2008).

The psychophysical and perceptive colour order systems are in the scope of this thesis because the study is based on the exploratory study of colour percepts. However, only the CIE system, the Munsell system, and the Natural Colour System (NCS) are discussed briefly in the following sections out of a few colour order systems such as the OSA-UCS (Optical Society of America Uniform Colour

[10] Wyszecki, G. & Stiles, W. S. (2nd Ed.). (1982). *Color Science.* New York: Wiley.

Scales), the DIN (Deutsches Institute für Normung), the Coloroid system, and the Colorcurve system. All above mentioned systems are generally organised to describe colours by their content corresponding to colour appearance attributes, i.e. hue, lightness, and chroma.

2.3.1 The CIE System

The CIE system (Commission Internationale d'Eclairage or International Commission on Illumination or CIE) is based on the science of colour measurement and derived from colour matching experiments by mixing coloured lights (Billmeyer and Saltzman, 1966; Berns, 2000). Colour matching experiments with light were first done by Newton in 1730. He found that "colours can be specified in terms of three numbers representing the amounts of the three primary lights [i.e. red, green, and blue] added together to make the match; thus term additive colour matching is used." (Billmeyer and Saltzman, 1966, p. 32). This experiment forms the basis of the CIE system. The CIE system provides not only international standards of visual colorimetry[11] but also a method for specifying colour stimuli under controlled viewing conditions (Ou, 2004). Marcus (1998) states that, "the CIE system of colorimetry attempts to simulate mathematically the perception of colour and provide a standardized procedure for measuring and quantifying that perception." (p. 36). In order to standardise the visual colorimetric match of an observer, the CIE system requires and provides standard light sources and a standard observer.

In 1931, the CIE recommended the use of standard light sources, or illuminants A, B, and C for viewing colour. These illuminants represent incandescent light, direct sunlight and average daylight, at the colour temperatures of about 2856, 4874 and 6774 Kelvin, respectively. In 1963, the CIE recommended a series of D illuminants which are called the CIE standard daylight illuminants, i.e. D65, D50, and D75. The most widely used D illuminants are D65 for surface colour industries and D50 for graphic arts industry (Ou, 2004).

In 1931, a particular set of imaginary primaries was selected by CIE and has been widely used for describing colours in the CIE system. These primaries are called tristimulus values of the spectrum and specified by X, Y, and Z which designates the standard coordinates of the CIE system (Billmeyer and Saltzman, 1966).

> These coordinates can be either determined directly in colour matching or measuring experiments with coloured lights or calculated from spectral reflectance curves with the aid of tables giving the tristimulus values of the pure spectrum colour at each wavelength, that is, $\bar{x}$, $\bar{y}$, and $\bar{z}$. These numbers are multiplied, wavelength by wavelength, by the reflectance of the sample and the relative energy of the light source, and the products are added up for all wavelengths in the visible spectrum. The sums are the tristimulus values of the sample (Billmeyer and Saltzman, 1966, p. 38).

The amounts of primary values are functions of wavelength and their spectral reflectance curves are called *colour-matching functions* (Berns, 2000). Colour-matching functions define "[…] how human eyes match a colour stimulus with an additive mixture of three primaries, the monochromatic red, green and blue lights." (Ou, 2004, p. 19). During the 1920s, two experiments were performed by J. Guild and W. D. Wright to measure the colour-matching functions of observers. Both experiments employed the same viewing conditions, subtending with a field of 2° visual angle that was surrounded by darkness. They found out that three monochromatic lights in 435.8 nm, 546.1 nm, and 700 nm wavelengths needed to match the colours of the spectrum. In 1931, the CIE characterised the visual response of an observer by adopting Guild and Wright's experimental data

[11] A process of a visual colour matching system is often called as visual colorimetry (Berns, 2000). Colorimetry, thus refers to "a synthesis of two words, colour and metrein (Greek meaning "to measure"). It is the sicience of colour measurement" (Berns, 2000, p. 45).

on colour-matching system (Berns, 2000; Şahin, 1998). This system is referred to as the *1931 Standard Observer* or the *2° Observer* which serves for visual field size of 1° and 4° and represents "[…] the colour-matching results of the average of the human population having normal colour vision." (Berns, 2000, p. 53). During the 1950s, several experiments were performed to measure colour-matching functions for larger fields of view. In 1964, the CIE recommended 10° field of view whenever colour-matching conditions were greater the field size of 4°. This new function defines the *1964 CIE Supplementary Standard Observer* which is referred to as the *1964 Standard Observer* or the *10° Observer* (Berns, 2000; Ou, 2004).

In the CIE system, colours of objects or surface colours are represented by tristimulus values X, Y, and Z, calculated by the spectral power distribution of the light source, the spectral reflectance, and the colour-matching functions (Ou, 2004). Colours as described in the CIE system are visually represented by the use of chromaticity co-ordinates x, y, and z which are obtained by taking the ratios of the tristimulus values to their sum (i.e. X + Y + Z). The common way of visualising the tristimulus values is to plot all colours into a two-dimensional space, called *chromaticity diagram* (Figure 2.1) (Berns, 2000; Ou, 2004).

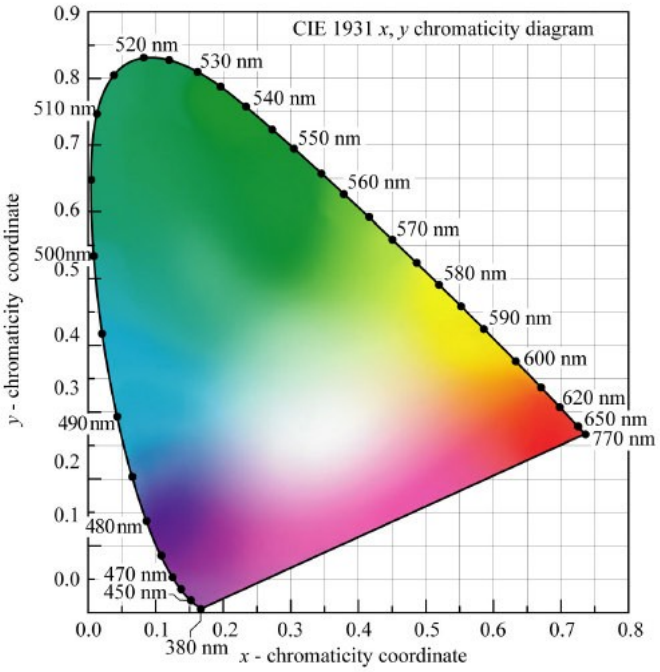

Figure 2.1 The CIE x, y chromaticity diagram for the 1931 standard colorimetric observer (Dikel, 2007, p. 32)

The 1931 CIE chromaticity diagram has two axes; the horizontal axis represents the x values and the vertical axis represents the y values as seen in Figure 2.1. The horseshoe-shape like curved line, called spectral locus, in this diagram shows the wavelengths of colours in the spectrum. The straight line connects the points representing the chromaticities of the spectrum colours called purple boundary. The enclosed area covers the domain of all visible colours and any perceivable colour has the reference to a coordinate with x and y values inside this area (Berns, 2000; Ou, 2004; Dikel, 2007). Although the chromaticity diagrams for the 1931 and 1964 CIE standard observers are different, their basic features are the same and the CIE x, y chromaticity diagram for the 1931 standard colorimetric observer is widely used (Berns, 2000).

The lack of the non-uniformity of the colour distributions in CIE x, y chromaticity diagram, the experiments by using material samples illuminated by a daylight simulator were conducted to

achieve a uniform colour scale diagram. In 1976, these experiments led to the recommendations of the two approximate uniform colour spaces, i.e. CIELAB and CIELUV (Schanda, 1996; Marcus, 1998). Kuehni (2003) defines uniform colour space as follows;

> A uniform colour space is a geometrical representation of colour perceptions in a three-dimensional space in which the distance between any two points can be taken as a measure of the magnitude of the difference between the two colour perceptions that are represented by the two points (p. 14).

Both the CIELAB and the CIELUV systems were tested against surface colours, colour-differences, or colour scales (Schanda, 1996). They are currently the most widely used colour spaces in colour researches and colour industries.

The CIELAB colour space was offered to use with surface colours (Ebner, 2007). It consists of three orthogonal dimensions *L**, *a** and *b** (Ou, 2004). *L** represents the vertical dimension and it correlates with perceived lightness, i.e. a perfect white has an *L** of 100, and a perfect black has an *L** of 0. The two horizontal dimensions *a** and *b** represent the redness-greenness and yellowness-blueness in CIELAB colour space (Marcus, 1998; Ou, 2004). Although the CIE does not publish any atlases to show the colours in CIELAB colour space, the RAL Design System[12] and the Eurocolor Atlas have been created. The first one arranges colours according to their CIE *L* a* b** notations and the second one arranges colours based on their CIE *L* C* h** notations, *L** represents the lightness, *C** represents the chroma and *h** represents the hue in colour space (Marcus, 1998).

The CIELUV colour space was suggested for self-luminous colours (Ebner, 2007). It consists of three orthogonal dimensions, *L* u* v**. *L** represents the vertical dimension and it correlates with perceived lightness and the two horizontal dimensions *u** and *v** represent the redness-greenness and yellowness-blueness, as well in CIELUV colour space (Ou, 2004). The CIELUV colour space is popular in the television and video display industries because the mixtures of coloured lights and phosphors are represented very simply on its chromaticity diagram (Marcus, 1998).

The CIE system was developed to describe colorimetric properties of signal lights, in general. However, after its introduction of the approximate uniform spaces, it has been used in areas of surface colour matching, in the textile, paper and coating industries to describe colour matches between colour sample and reference (Schanda, 1996). In this thesis, the CIELAB is utilised in order to indicate the specifications of the colours that are used in the study.

2.3.2 Munsell Colour System

The Munsell colour system was developed by the American painter Albert H. Munsell in 1905 as a teaching aid for art students (Berns, 2000). The Munsell system has been regarded as an approximate uniform colour space which is based not only on the measurement of colour sensations but also on careful psychophysical observation, experimental measurements, and physical and mathematical methods (Marcus, 1998; Zollinger, 1999; Ou, 2004; Bergström, 2008). Colours in this system are arranged according to the perceptual differences of the three attributes of colour, hue, lightness, and chroma, referred to *Munsell Hue*, *Munsell Value*, and *Munsell Chroma*.

Munsell Hue depends on five principal hues, i.e. red, yellow, green, blue and purple; and five intermediary hues, i.e. yellow-red, green-yellow, blue-green, purple-blue, and red-purple (Mahnke,

[12] RAL Design System is colour matching system which is mainly used for varnish and powder coating in Europe (Kuehni, 2008).

1996). These ten hues of the Munsell system are based on the afterimage[13] perceptions that are derived from colours in nature (Feisner, 2001). Hues in this system are arranged clockwise in a circle with numerical classifications of decimal system and abbreviated by initials such as R for red or BG for blue-green (Berns, 2000). Furthermore, each hue is subdivided into four units, i.e. 2.5, 5, 7.5, and 10, and designated by its hue initial 2.5R, 5R, 7.5R, and 10R. These are used for the identifications of hues which are shown at the inner circle of the colour wheel. At the outer circle of the colour wheel, the divided ten sections of each hue are shown by the numerals from 1 to 100 (Mahnke, 1996). It can be briefly said that the hue scale of the Munsell system is based on a subdivided scale which consists of 100 equally spaced Hue radii (Şahin, 1998). Şahin (1998) describes the equally spaced Hue radii as follows; "the end hue radius of one range corresponds to the beginning hue radius of the next range. For each hue range there is a major hue, which is located at the middle of Hue range, represented with the number 5 and […] intermediate radii 2.5, 7.5, and 10." (p. 85). The letter N at the centre of the colour wheel signifies the neutral, non-chromatic or achromatic value of hues closest to the vertical axis (Feisner, 2000). Figure 2.2 shows the related hue ranges arranged on 100 hue circuit which represents the colour wheel of the Munsell system.

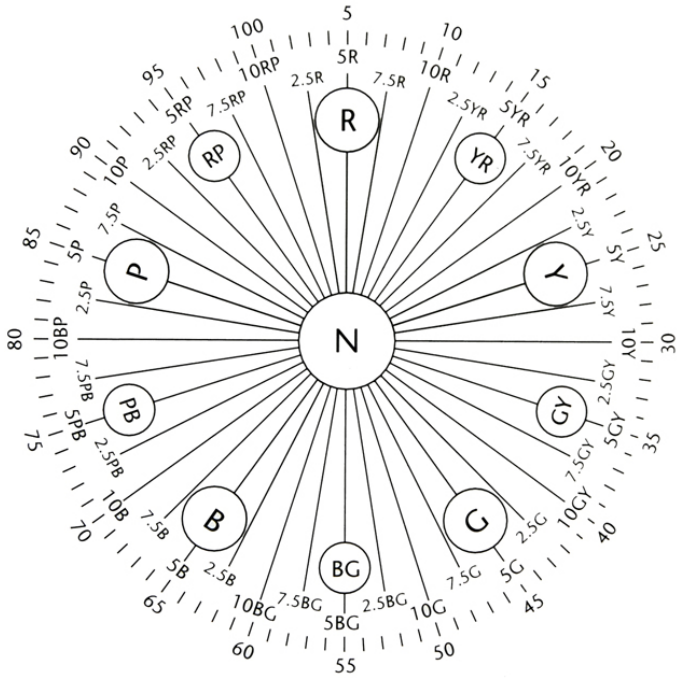

Figure 2.2 Colour wheel of the Munsell system with related hue ranges on 100 hue circuit (Feisner, 2001, p. 18)

Munsell Value is based on ten steps ranging from absolute white (value symbol 10) to absolute black (value symbol 0), called neutral scale or value scale. Achromatic colours in neutral scale find to be visually equally spaced and are based on their luminous reflectance. These colours are notated with the prefix N from N0 to N10. This visual instrument of achromatic colours represents the different values of each hue and shows the relationship that would be applied equally to chromatic colours (Berns, 2000). The notation 5 in the middle value for grey represents the halfway between black and white. For instance, a blue with the notation 9 would be a light blue; one with the notation 3 would be a dark blue (Mahnke, 1996; Marcus, 1998).

[13] Feisner (2001) describes afterimaging as "an optical reaction that occurs after we stare intensely at a hue and then shift our eyes to a white surface; the second hue is termed the afterimage" (p. 10).

Munsell Chroma depends on an open-ended scale and represents the chromatic intensity, or strength, or purity of object colours (Kuehni, 2004). The chroma scale of the Munsell system distinguishes a strong colour to a weak one and the extent of its departure from grey (Şahin, 1998; Bergström, 2008).

All three attributes of colour in the Munsell system are perceptually equally spaced. The hue scale of the Munsell system is interval scale[14], whereas the value and the chroma scales are ratio scales[15] (Choudhury, 1996). The geometric arrangements of the three attributes of the Munsell system are cylindrical, called the Munsell colour space (Kuehni, 2000). Figure 2.3 shows the arrangements of the hue, value, and chroma scales in the three-dimensional colour space of the Munsell colour system.

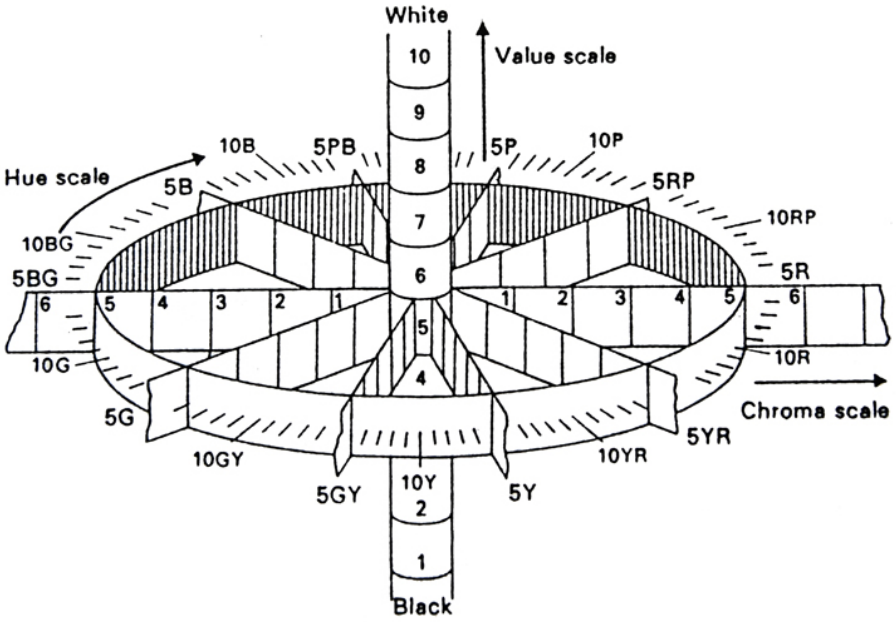

Figure 2.3 The three-dimensional colour space of the Munsell colour system (Şahin, 1998, p. 86)

Figure 2.3 visualises the three dimensions of the Munsell system in terms of a colour space. The central vertical axis is the achromatic scale or the neutral-value scale which is graded in equal visual steps from black, through grey to white. The greys between black and white have values from 1 to 9 as they become lighter. The hue scale is represented along the circumference of a circle which is positioned around the neutral axis. Hues are also equal in visual steps and are divided into five principal (i.e. R, Y, G, B, and P) and five intermediate (i.e. YR, GY, BG, PB, and RP) hues. The chroma scales starting at the neutral axis in the centre and radiate in equal steps outward to the periphery of the colour space. The illustration in Figure 2.3 shows the chroma scales starting at the middle grey value of 5. They are measured on a horizontal axis starting at a zero chroma, proceeding out with dull grey hues to the direction of the hue scale and reaching at the brightest hues at the outer boundary (Choudhury, 1996; Mahnke, 1996; Feisner, 2001; Ou, 2004).

[14] Choudhury (1996) claimed that "equal numerical interval [of the hue scale of the Munsell system] indicates equal perceived difference of attribute" (p. 57). This means that this scale has an arbitrary zero point and it does not mean the absence of the property (Meyers, Gamst and Guarino, 2006).

[15] Choudhury (1996) indicated that the value and chroma scales of the Munsell system are interval scales having natural origin. This means that these scales have an absolute zero point, where zero means absence of the property (Meyers et al., 2006).

The three-dimensional colour space of the Munsell system was expected to be a sphere however "[…] limiting the range of colours to a sphere would be misleading because for different pigments, different maximum chroma occurs at different lightness." (Berns, 2000, pp. 36-37). The varying intensity of different pigments in the Munsell colour solid led to obtain the form of spheroid with an irregular outline (Figure 2.4) (Kuehni, 2003).

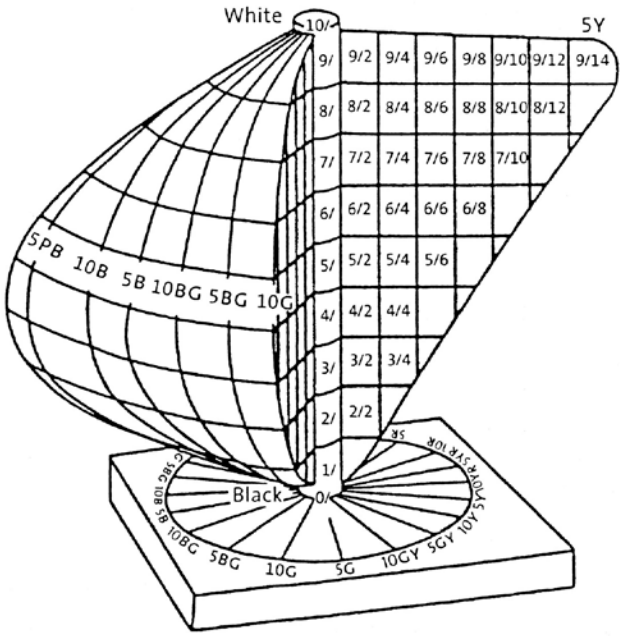

Figure 2.4 Diagrammatic representation of the Munsell colour solid with one quarter section removed to show constant hue 5Y (Şahin, 1998, p. 87)

The Munsell colour solid is represented by a series of charts. Each chart corresponds to a particular hue, i.e. red, yellow, yellow-red, and etc., and colour chips are arranged upon each chart. The colour chips on each chart are arranged in a particular horizontal row of equal lightness however they vary in degree of saturation in equal visual steps, with the least saturated colours on the inner edge. (Zollinger, 1999). A Munsell notation is defined as H V/C. H represents hue, V represents value and C represents chroma. For instance, 5Y 6/8 has the meaning of the colour chip of hue 5 yellow, lightness of 6 and chroma of 8. A value of 6 indicates a more than the middle of the lightness scale and a chroma of 8 indicates a fairly pure colour.

In 1905, a description of the system with print reproductions of colour charts, A Colour Notation, was published by Munsell. In 1907, Munsell published a portfolio of eight plates with painted paper samples as the first version of his Atlas of the Munsell Colour System. In 1915, the extended version with fifteen plates and a total of 880 colour samples were released. In 1929, Munsell Colour Company produced painted paper chips of Munsell colours and the first version of the Munsell Book of Colour was commercialised with a collection of 40 pages containing colour chips of various value and chroma of one given hue. In 1943, the colorimetry committee of the Optical Society of America (OSA) adopted the Munsell system and improved the correlation of the system with psychophysical scales and instrumental colour measurements. After the modifications of the system, the OSA Subcommittee on Spacing of Munsell Colours published the CIE tristimulus values of ideally spaced chips the so-called Munsell Renotations. The Renotations are expressed in terms of CIE 2° observer and C illuminant and the committee defined 2746 chromatic and 9 achromatic colours. In the commercial system, approximately 65% of the colours of the Munsell system have been realised as colour chips. Computer software programs have been developed to calculate the Munsell notations from a sample's X, Y, Z tristimulus values. The Munsell system is widely known and used as a uniform

global colour order system in colour industries and colour researches (Choudhury, 1996; Marcus, 1998; Berns, 2000; Kuehni, 2000, 2003, 2004).

2.3.3 Natural Colour System

Natural Colour System (hereinafter NCS) was based on German physiologist and psychologist Ewald Hering's phenomenological[16] theory from 1874 about the natural order system (Hård, Sivik and Tonnquist, 1996). Hering (1878; as qtd in Hård and Sivik, 2001) formulated his system by defining as follows;

> In order to serve as a basis for aesthetic studies of colour, a colour system must only consider attributes of the colour sensation as such (the colour percept), i.e., those which can be perceived and assessed solely by means of the innate colour sense. All concepts referring to colour material or light stimuli must strictly be excluded (p. 5).

Hering's criteria for such a colour system provided the terminology of the opponent colour theory which was based on his phenomenological analysis. According to Hering, the concept of opponent theory should be utilised to explain the visual appearance of the colours which was described as subjective rather than physical or physiological phenomenon (see Section 2.1) (Hård and Sivik, 2001). Hering defined his phenomenological analysis of the opponent colour theory as in the following;

> Two intermediate hues that belong to two opposite quadrants of the colour circle, such as the red-yellow and the green-blue are opponent in two respects [red against green and yellow against blue]; but if they belong to two adjacent quadrants, such as the red-yellow and the green-yellow, then they are opponent in only one respect [red against green with yellowness in common] (Hård and Sivik, 2001, p. 5).

Hering proposed six elementary colours, i.e. black, white, yellow, red, blue, and green. According to Hering; "these six constitute our conceptions of the simple and unambiguous colour sensations that we carry with us as a kind of inner reference system" (Hård et al., 1996, p. 184). Hering continued by further saying "these elementary colours have no characteristic resemblance to each other, while all other colour percepts remind us of two, three, or four of these six" (Hård et al., 1996, p. 184). In other words, according to him, any particular colour would only be defined by the degree of its resemblance to these six fundamental colours, referred to as elementary colour attributes (Taft, 1997). Hering therefore, considered these colours to be natural (Berns, 2000).

In 1937, Swedish colour researcher Tryggve Johansson interpreted Hering's idea and introduced the name *the Natural Colour System* (Hård et al., 2001). Johansson's development of Hering's theories about colour and colour vision was then adopted by Sven Hesselgren. In 1952, the first exemplification of the system was published under the name of *Hesselgren Colour Atlas*. In 1964, the extensive research was conducted by Anders Hård, Lars Sivik, and Gunnar Tonnquist and they developed the current formulation of the NCS which is based on Hering's original concept of six elementary colours rather than Johansson and Hesselgren's interpretations (Taft, 1997; Bergström, 2008). In 1979, after the *Scandinavian Colour Institute AB* was established, the exemplification of the NCS colour notation system was released as the *Swedish Standard Colour Atlas* and has also been introduced in several other countries in the world (Hård et al., 1996; Berns, 2000).

The NCS is a system for ordering of colours which is not only based on the visual properties of colour percepts but also on the human sense of colour vision (Tonnquist, 1989; Hård et al., 1996). The

[16] Hård and Svedmyr (1995; as qtd. in Fridell Anter, 2000) defined the term phenomenology as "[the] description and classification of perceptual phenomena without attempts to explain them with the help of physical or physiological causalities." (p. 16).

system depends on six elementary colours, i.e. the two achromatic colours pure White (W) and pure Black (S, swarthy); the four chromatic colours pure Yellow (Y), pure Red (R), pure Blue (B), and pure Green (G) whose appearance can only be described by themselves (Taft, 1997). The system moreover orders colours due to their perceptual elementary attributes (Hård et al., 1996). These attributes are quantified and described as whiteness, blackness, yellowness, redness, blueness, and greenness, called the quality attributes of colour and represented by lowercase letters (i.e. *y* for yellowness, *w* for whiteness, *s* for blackness, and etc.) (Hård, 1969).

Hård (1969, p. 358) states that the six quality colour attributes can be verbally defined without using any visual reference scales as follows;

> **Yellow:** neither greenish nor reddish and neither blackish nor whitish,
> **White:** a colour perception, which is neither chromatic nor blackish,
> **Black:** a colour which is neither chromatic nor whitish,
> **Red:** neither yellowish nor blueish and neither blackish nor whitish,
> **Blue:** neither reddish nor greenish and neither blackish nor whitish,
> **Green:** neither blueish nor yellowish and neither blackish nor whitish,
> **Pure Chromatic:** all colour perception which are neither blackish nor whitish.

All other colours can be described by their degree of visual resemblance to these elementary colours and these resemblances are the elementary attributes that are discussed. The elementary colours and the interrelationship of all colours are represented by a three-dimensional imaginary colour space resulting in *NCS Hue*, *NCS Blackness* (or *NCS Whiteness*), and *NCS Chromaticness* scales (Berns, 2000; Bergström, 2008). The scales of these variables are obtained by the psychometric methods (Tonnquist, 1989). The NCS colour space is represented as a double cone- like structure. It has a central vertical axis with white and black at the endpoints and is surrounded by a horizontal hue circle where the four chromatic elementary colours are placed in opposite each other, i.e. red is opposite to green, and yellow is opposite to blue (Figure 2.5) (Taft, 1997).

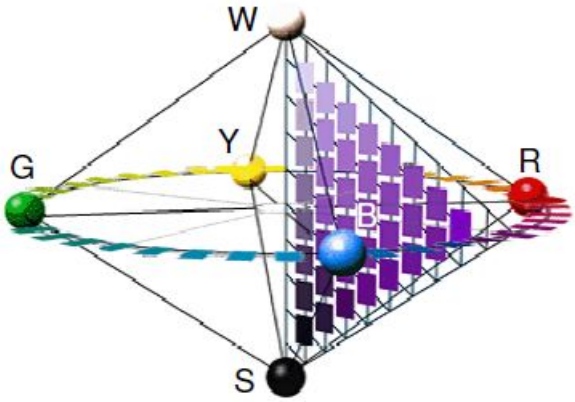

Figure 2.5 Diagrammatic representation of the NCS colour space (Dikel, 2007, p. 34)

The NCS colour space is generally presented in two projections, i.e. the *NCS Colour Circle* and the *NCS Colour Triangle*. The NCS colour circle is a horizontal section through the middle of the colour space which consists of the NCS hues with four interconnected bi-polar scales. Each bi-polar hue scale connects the four chromatic elementary colours, i.e. Y-R, R-B, B-G, and G-Y. Each quadrant between adjacent elementary chromatic colours is divided into 100 equal steps and each NCS hue is defined as a percentage between these two elementary colours. The NCS hue is denoted by the Greek letter phi (ϕ) and specified by a notation in the NCS colour circle. For instance, the designation "Y90R" denotes the numeric value of a given hue in which Y and R represent the chromatic elementary colours and 90 indicates the degree (or percentage) of the resemblance between these two colours that the colour shows. Thus the hue Y90R has 10% perceived resemblance to yellow and

90% perceived resemblance to red (see Figure 2.6) The NCS hue can be briefly defined as the relationship between the two chromatic elementary attributes (Taft, 1997; Berns, 2000, Fridell Anter, 2000).

The NCS colour triangle is a vertical section through the NCS colour space and is equilateral. The corners of the NCS triangle correspond to the elementary colours white (W), black (S), and the colour of maximum chromaticness (C). As in the NCS colour circle, the scales for the NCS whiteness, blackness and chromaticness are divided into 100 equal steps and taken as percentages resulting in *NCS Nuance*. The NCS nuance is defined as the relative resemblance of colours to the elementary colours W, S, and the pure chromatic colour C and specified by a notation in the NCS colour triangle. In other words, colours of the same hue can have different blackness or chromaticness that is different in nuances. For instance, the designation "1050" is the numeric value of a given nuance where the first two digits represent the blackness and the following two represent the chromaticness. The whiteness is calculated according to the equation $s + c + w = 100$. Thus the nuance 1050 has 10% of blackness, 50% of chromaticness and 40% of whiteness. In the NCS nuance only the attributes of blackness and chromaticness are recorded (see Figure 2.6) (Berns, 2000; Fridell Anter, 2000; Bergsrtöm, 2008).

The designation of hue and nuance together make up the complete colour notation system in NCS. The colour specifications are given in the form of, for instance, 'S 1050 - Y90R' where the letter 'S' at the beginning represents the term *Standard*, and then the nuance and the hue of a chromatic colour (see Figure 2.7). Achromatic colours are specified as 5000-N for instance, which represents the grey colour with 50% of blackness, 50% of whiteness, and 0% of chromaticness and is denoted with the letter *N*, called neutral (Fridell Anter, 2000; Bergström, 2008).

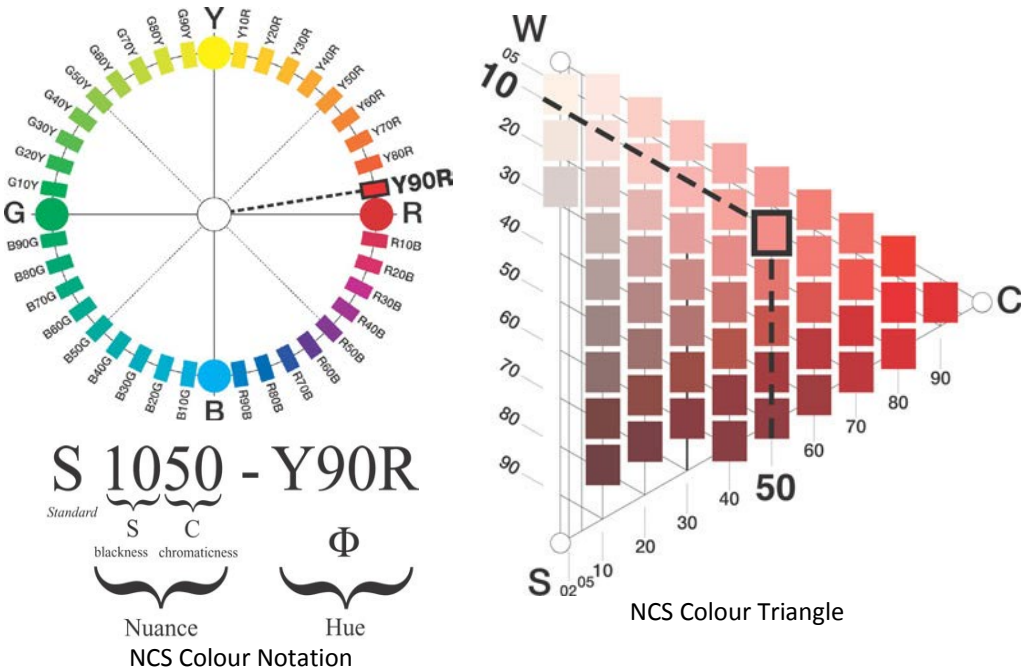

Figure 2.6 NCS colour circle, NCS colour triangle, NCS colour notation (Dikel, 2007, p. 34)

The colours in the NCS system are specified by their hue, blackness, and chromaticness. It should be noted that the NCS is the only colour order system that uses blackness rather than lightness as a perceptual dimension to define colours. Taft (1997) claims that "According to the NCS, lightness is a colour differentiating or discriminating variable important in contrast perception or edge detection." (p. 16). He continued further by saying "[…] unlike blackness, lightness does not contribute to the

description of the appearance of any single colour percept, but rather to comparisons between colour." (p. 16). The NCS is a colour standard which is considered as a universal language of colour communication. Hård et al. (1996) claimed that "The NCS colour notation system is general in the sense that it makes possible a description of object colours [or surface colours] as they appear in any given viewing and illumination situation." (p. 204). In the scope of this thesis, the NCS system is found to be useful to utilise for the verbal descriptions of the basic colour percepts in the study.

The colour order systems or colour notation systems thus are utilised in the world of colour industries, design, planning, and researches in order to eliminate the misunderstanding of communicating about colours with words. In ordinary life, people communicate verbally about colours by giving names to them which is the subject matter of the next section and is discussed in details in the following.

2.4 Basic Colour Terms

People with normal colour vision see colours similarly; however, their interpretations or naming of that colour can be different depending on memories, experiences, educational, social and cultural backgrounds. For instance, one may call the colour that he perceives as blue, whereas another may think of that the same colour as blue-green or purple-green. The use of colour names enables people not only to describe colours related to certain things in the surroundings but also to convey information to communicate with others which is called *colour naming* (Hård, 1969; Lin, Luo, MacDonald and Tarrant, 2001).

Lin et al. (2001) define colour naming as the verbal expression of the way of describing or categorising a colour. Lin et al. (2001) claim that "colour categorisation allows a colour to be assigned to a specific colour group, by performing a mapping from a set containing a very large number of names for finely graduated colours into a set containing only a few well-differentiated colours." (p. 40). Hård (1969) supports these category perceptions of colour in terms of the results that he so-called "the intention with the observation" (p. 354). The irregularities in his findings as follows;

> So for instance: a yellow which is made a little more greenish will very soon be called a green colour even if it is more yellowish than greenish. If it becomes reddish however, it will continue to say yellow to a point where it will be called orange. When a strong blue or green becomes whitish and or greyish or blackish it will be seen as blue or green but when a strong yellow or red becomes blackish or greyish they will perceive as brown. And a whitish yellow is still yellow, by a whitish red is not red but pink (p. 356).

The categorisation of a colour is considered as the most important cognitive function in cognitive psychology, people therefore have often needed a simple way of communicating colour, so-called "the simplification law of colour perception" (Hård, 1969, p. 356). Although significant kinds of variations occur between different cultures and individuals in naming or classifying a colour, red for instance is categorised simply as 'red' from the thousands of its tints or shades. It can be said in the sense that colour naming is necessary only to distinguish the colours from other categories such as yellow, green, blue and etc. (Lin et al., 2001).

Many studies have been carried out either to determine how people categorise colours or to define how people attach linguistic labels to colours in terms of the language they speak. Taft (1997) claims that people have few terms that they regularly use to name colours and they are easily translatable from one language to another. Whether Taft's statement is true or not, colour naming and categorising have been considered as a significant subject matter to be discussed by anthropological and linguistic inquiry in terms of philosophical viewpoints of absolutism, relativism, and universalism.

Since the identification of colour categories go back at least to Aristotle's description of the rainbow (350 B. C.), the scientific report on the physical spectrum dates back to Newton's experiment on the prismatic dispersion of white light (Bornstein, 1975). Newton (1671-72[17]; as qtd. in Bornstein, 1975) categorised and labelled the diffracted spectrum as follows; "There are therefore two sorts of colours. The one original and simple, the other compounded of these. The Original or primary colours are, *Red, Yellow, Green, Blue,* and *Violet=purple*, together with *Orange, Indigo*, and an indefinite variety of Intermediate gradations." (p. 775). Newton's description of the spectrum was based on his perceptions. In other words, Bornstein (1975) defines Newton's perception of the diffracted spectrum as "[…] Newton *saw* and then *labelled* the photic spectrum as he saw it." (p. 776). This view refers to the ideas of absolutism or phenomenal absolutism, of which Newton's categorisation of the colours in the spectrum can be considered as a significant example. Absolutism argues that the language terms are the result of visual processing which do not differ among individuals and only occur in labelling the primary perceptions (Şahin, 1998).

The realism of the view point of absolutism has been challenged, on the other hand, by relativism or called cultural relativism. Relativism argues that perceptions are influenced by the linguistic especially by the semantic and cultural differences which mean that each language imposes its own particular evaluative system. Relativist idea also claims that colour perception and its terminology reflect the cultural dispositions and the variations in colour names are posited from the differences in the structural and lexical characteristics among languages (Bornstein, 1975; Taft, 1997). According to the relativists, the names of shades or tones of hues are more important to reflect the features of a specific culture than the terms of the primary colours (Şahin, 1998). The relativist view of colour naming in the 20th century was predominant in anthropology, linguistics and psychology, however nowadays a considerable literature on colour naming in various disciplines has been accumulated within the idea of universalism (Taft, 1997).

Universalism argues that the basic psychological processes are common among individuals however these processes are influenced by culture and expressed in different ways (Şahin, 1998). The universalist idea also proposes that "[…] there are areas of the colour space which are perceptually more salient to all peoples and that these areas both are more codable and can be better remembered as the direct result of their salience." (Taft, 1997, p. 23). A development in the universalist understanding of colour categorisation came from a study that was conducted by the two anthropologists, Brent Berlin and Paul Kay in 1969. The basis of their study depended on the discoveries of the regularities in the shape of the basic colour lexicons across different languages (Mojsilovic, 2002).

Berlin and Kay (1969, p. 2) proposed in their study that "[…] each language performs the coding of experience into sound in a unique manner. Hence, each language is semantically arbitrary relative to every other language." In accordance, they hypothesised further by saying that "colour words translate too easily among various pairs of unrelated languages for the extreme linguistic relativity thesis to be valid." (p. 2). In order to test this hypothesis, Berlin and Kay (1969) designed an experimental test with native-speaking informants in each of 20 languages which were based on a number of unrelated language families. The subjects first were asked to list of all colour terms in their language. Then the investigators determined the basic colour terms from the elicited lists of terms by applying the following set of linguistic criteria.

- The colour name should be *monolexemic* which means that it does not derived from the meaning of one of its parts; i.e. blue rather than bluish or blue-green, or sky blue.
- The signification of the colour name is not contained by any other colour term; i.e. crimson or scarlet are a kind of red.
- The colour names should be restricted to a narrow class of objects; i.e. blond that is restricted only to hair, complexion, and furniture.

[17] Newton, I. (1971-72). New theory about light and colours. *Philosophical Transactions of the Royal Society, 80*, 3077-3087.

- The colour name should be *psychologically salient* for informants. The guides of psychological salience include: a. the placement at the beginning of elicited lists of colour terms; b. the stability of reference and general use across informants; c. generally known in the dialects of all the same language informants; i.e. crimson (Berlin and Kay, 1969; Taft, 1997; Zollinger, 1999).

After using the four characteristics for the determination of basic colour terms and supplementing this limited field study with a literature search on 78 languages (totally 98 languages) (Hardin and Maffi, 1997), Berlin and Kay (1969) found out that a total universal list of eleven basic colour categories exist, i.e. white, black, red, green, yellow, blue, brown, purple, pink, orange, and grey. Each informant was then asked to identify the best examples (so-called focal colours) of each his basic colour terms from a two-dimensional array in the Munsell Book of Colour (see Section 2.3.2). The array consisted of 329 spaced Munsell colour chips of maximum saturation with different hues and lightness (Heider, 1972; Taft, 1997).

Berlin and Kay (1969) also suggested that the numbers of basic colour terms were varied among languages, from a minimum of two terms to a maximum of eleven terms. They claimed that these eleven basic colour terms had a temporal ordering of stages which were based on the relationship between cultural complexity and complexity of colour vocabulary. The stages of the hierarchy of the basic colour terms are shown in Figure 2.7.

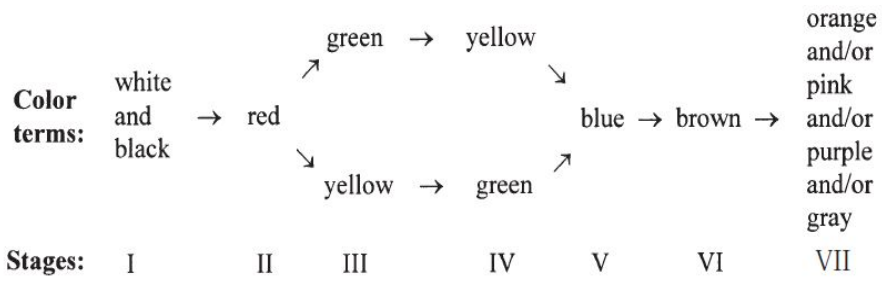

Figure 2.7 Berlin and Kay's seven stages in the evaluation of basic colour terms (Zollinger, 1999, p. 129)

Berlin and Kay (1969) stated that if a language has two terms, it includes only white and black (a Stage I languages); if it has three terms, it includes white, black, and red (a Stage II languages); if it has four terms, it includes white, black, red, and fourth either green or yellow (a Stage III languages), and a fifth the remaining one of these two (a Stage IV languages); if it has six terms, blue is added to previous five terms (a Stage V languages); if it has seven terms, brown is added to previous six terms (a Stage VI languages); and the terms orange, pink, purple, and grey are added in no particular order to previous seven terms (a Stage VII languages) (Hardin and Maffi, 1997; Zollinger, 1999).

Berlin and Kay's study have been used as a model in the cross-cultural research on colour categorisation and naming. There have been conducted a large number of colour naming studies to search for the focal colours of the basic colour terms in different cultures. In these studies, the main purpose is to ask which colour corresponds with its name mostly or precisely according to the perceiver.

In this thesis, the colour stimuli used in the explorative study are based on the perception of the basic colour terms. The study is carried out in Turkey with Turkish participants; therefore, in order to prevent the cultural differences, Şahin Ekici et al.'s (2006) research on 'Colour Naming' is utilised to select the colours for the study. Şahin Ekici et al.'s (2006) research was conducted in six cities among different regions of Turkey with the participation of Turkish people. Three hundred and twenty two participants were asked to select the best representation of colour samples from the Munsell Book of Colour (see Section 2.3.2) which corresponded mostly with eight basic (except black, grey and

white colours) and the 24 non-basic colour terms. As the study of this thesis is based on the basic colours, only the results of the eight basic colours from Şahin Ekici et al.'s (2006) study are taken into consideration (see Section 4.6).

2.5 Colour Psychology

Since colour is part of many sciences, it can be not only described through some systematic methods such as colour system, colorimetric values, or colour name as a physical phenomenon or a physiological mechanism but also through colour sensation or feeling, colour perception or cognition as a psychological mechanism. Colour is considered as a psychological experience which has subjective occurrences in the perception or sensation of a colour of an observer. For instance, most people perceive the colour red in the same way; however the interpretations of a certain red colour can be different from one person to another. These differences of an observer's experiences of colour are defined in psychology as a cause of his unconscious, subconscious, and conscious processes (Mahnke, 1996).

The unconscious experience involves the innate experiences including biological and those related to personal thoughts, memories, impulses, desires, and feelings that are not conscious. The subconscious experience, on the other hand, is defined as learned experiences rather than instinctive. It refers to mental processes occurring not fully aware, which are ingrained in human's behaviour passed from family, social and cultural norms. Last but not least, the conscious experience implies preferences and associations that people are aware of which are based on each individual's personal thinking, feeling, and experiences. These preferences, associations and emotions are influenced by education, social and cultural background, as well as age, race, and gender (Mahnke, 1996; Lee and Lee, 2006).

In accordance with the definitions of three categories of human behaviour in psychology above, it can be said in the sense that colour is an essential part of psychology with unconscious, subconscious, and conscious responses that are integral in human behaviour (Mahnke, 1996). The psychology of colour has been a great of interest to many psychologists and researchers for more than a century. The effects of colour in a psychological level have been investigated as a multidisciplinary research approach by carrying out different degrees of experiments and studies. A wide range of literature exists on colour psychology which can be divided into two broad categories of interest. The first category of the colour psychology research is concerned with preference, pleasantness, or the evaluative dimensions of colour and those relate with descriptive colour dimensions (see Section 2.2). The second category of the colour psychology research is based on association or connotation, meaning, and emotion of colour, with the intention of finding out the relationship between semantic variables and perceptive colour dimensions (see Section 2.2). Colour meaning and colour emotion research constitute a significant part in this thesis which are discussed in the following sections. Although colour preference research is beyond the scope of this thesis, it is briefly discussed under the section of colour meaning as well because it is also considered as an aspect of colour meaning research (Taft, 1997).

2.5.1 Colour Meaning

The essence of colour has been questioned throughout history and in the scientific world. This is done not only by asking how people see colours but also how people perceive colours that surrounds them (Sharpe, 1974). Although these two approaches are not independent from each other, colour can be described in the context of these two different points of view, in general. While the first approach can be considered as an objective point of view by referring to physics and physiology, the second approach can be considered as a subjective point of view by referring to psychology. However, the perception of colour both depend on physical and psychological aspects, i.e. the relationship between the physical input and the human response which has a psychological

component (see Section 2.1) (Mahnke, 1996). The psychological aspects of colour perception can be influenced by memories, experiences, educational, social and cultural backgrounds, as well as age, gender and race. Thus, the effects and differences of age, gender, cultural background and personal traits on colour have been of interest to psychologists and researchers (Taft, 1997).

Sivik (1974a) states that the preference order of colour was investigated primarily by the first psychological experimentalists concerning with the question of whether colour preferences are subjective or there are a widespread agreement about the attractiveness of colours or any agreement is moderated by age, gender and personality differences among people (Crozier, 1999). Cohn (1894[18]; as cited in Taft, 1997) has been accepted as a pioneer who produced a large body of literature in the field of colour preference. Since then, the effects of age, gender, cultural background, and personal traits on colour by asking why one colour is more appealing, beautiful, liked or preferred than the other for single colours and how colours affect people have been major subjects for colour preference research (Sivik, 1974a; Ou, 2004).

Taft (1997) claims that colour preference research are based on univariate investigations of the ranking orders of colours which measure preference judgements only focusing on one single dimension, i.e. pleasantness-unpleasantness of colours (Camgöz, 2000; Akbay, 2003). Sivik (1974a) states that this unidimensional aspect of colour preference is evaluative and has an affective value, therefore, this initial period of colour research on colour preference often referred to as affect studies (Taft and Sivik, 1992). Taft (1997) claims that colour preference is considered as one of the major categories of colour meaning research because of being evaluative and having affective value. Sivik (1974a, p. 3) points out that "The concept of preference value [i.e. pleasantness-unpleasantness] […] can be considered to be a special case of connotation." However, he goes further by stating that the subjects' associations and meanings to the different colours, rather than only the evaluative dimension, are necessary to be categorised and described in terms of three colour appearance attributes, i.e. hue, lightness and saturation (see Section 2.2). The reason for this is that, colour preference has focused more on the colour dimension of hue rather the variations in lightness and chroma (Taft, 1997). Additionally, Norman and Scott (1952, p. 187) points out that "Most of the earlier preference surveys failed to to control the three classical "psychological dimensions" of hue, chroma, and tint, and also neglected to treat the data statistically to determine significances of observed differences." In accordance with Norman and Scott's (1952) argument, Granger (1955[19]; as cited in Taft and Sivik, 1992) and Guilford and Smith (1959) investigate the relationships between preference ratings and the colour dimensions, i.e. hue, lightness and saturation. Both studies point out the similar results that, the colour dimension of hue is the primary function of colour preference, where blue is found as the most pleasant and preferred colour, the colour yellow is found as the least. In addition to hue, the results of both studies show that preferences of a colour increases with increasing the saturation of that colour. These studies demonstrate the importance of searching for the dimensionality of colour in colour studies (Taft and Sivik, 1992).

Then, the univariate preference investigations are altered to multivariate investigations involving studies of associations and/or connotations of colours, called colour meaning. Since colour is considered as an aspect of perceived dimension, it connotes meaning by associations. Sivik (1974a) simply defines colour meaning as the relationships between colour percepts and the associations or connotations that they evoke. Birren (1961[20]; as cited in Mahnke, 1996) finds that, red; for instance,

[18] Cohn, J. (1894). Exprimentelle undersuchungen über die gafühlsbetonung der farben, helligkeiten und ihrer combinationen. (Experimental investigation of the emotional effect of color, lightness and their combination). *Philosophical Studies, 10*, 562-603.

[19] Granger, G. W. (1955). An experimental study of color preferences. *The Journal of General Psychology, 62*, 3-20.

[20] Birren, F. (1961). *Color psychology and color therapy*. New York: University Books.

primarily evokes associations or images of heat, fire, blood, sexuality and love for just about everyone, nevertheless, Sivik and Taft (1992) state that, the same colour may have or carry a very special meaning for each person. Therefore, the associations or connotations to colour are often called meanings of colour.

Dimensions of meaning in psychology research dates back to Charles E. Osgood and his two associates, George J. Suci and Percy H. Tannenbaum, who have been accepted as the pioneers within this area of research. In their publication, *The Measurement of Meaning*, in 1957, the three psychologists are done systematic attempts to quantitative measurement of the subject meaning in order to intense the objectivity in psychology. Osgood et al. (1957) defines *meaning* as a "[…] cognitive state […] [which is identified] with a representational mediation process [...]" (p. 9) and assert that "[…] it certainly refers to some implicit process or state which must be inferred from observables […]" (p. 1). They state further;

> […] How a person behaves in a situation depends upon what that situation means or signifies to him. And most would also agree that one of the most important factors in social activity is meaning and change in meaning – whether it be termed "attitude", or "value", or something else again (p. 1).

Osgood et al. (1957) state that although the psychologists have scaled considering the number of traits and attitudes of people, the little effort has been shown in order to measure meaning in this way. Therefore, they developed a particular kind of measurement instrument, which Osgood has called *the semantic differential* (hereinafter SD). The SD is defined as a technique for measuring meaning and is based essentially on a combination of association and scaling procedures (Osgood et al., 1957). Osgood et al. (1957) describe the SD as follows;

> We provide the subject with a concept to be differentiated and a set of bipolar adjectival scales against which to do it, his only task being to indicate, for each item (pairing of a concept with a scale), the direction of his association and its intensity on a seven-step scale (p. 20).

In accordance, Osgood et al. (1957) generate the pairing of 50 adjectival scales with 20 concepts in order to measure meaning which makes 1000 separate judgements. Forty of these adjectival scales were taken from the original stimulus word list of Kent and Rosanoff (1910[21]; as cited in Osgood et al., 1957). The subject is presented with a concept (or stimulus), i.e. lady, father, boulder, sin, lake or symphony, etc., and with a series of bipolar adjectival scales, i.e. happy-sad, hard-soft, good-bad or sweet-sour. Then, the subject is asked to judge the concept in terms of its association to 50 adjectival scales separately whether it is happy or sad, hard or soft, etc., on a seven-point rating scale. After the subject judges a concept, he/she is asked to judge other concepts (in total 20) in this way (Carroll, 1959).

Osgood et al. (1957) believe that meanings vary multi-dimensionally rather than only having one dimension, i.e. evaluative dimension (favourableness-unfavourableness or pleasantness-unpleasantness). Carroll (1959) claims that the adjectival scales that Osgood et al. used in the SD under their study, constitute all possible dimensions of meaning. Therefore, in order to find the dimensionality in meaning, Osgood et al. (1957) used factor analysis[22], in order to reduce these dimensions to a certain minimal set of scales of judgements (Carroll, 1959). In accordance, they found that 50 polar adjectival scales label themselves as to their contents with three independent

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[21] Kent, G. H. & Rosanoff, A. J. (1910). A study of association in insanity. *American Journal of Insanity, 67*, 37-96.

[22] The factor analysis is a statistical method which is first introduced by Spearman in 1904. It is used for the mathematical analysis of correlations between variables (Sivik and Taft, 1989) (see Section 6.1.1).

semantic dimensions or factors of meaning. These SD dimensions are identified as *Evaluation* (E), *Potency* (P), and *Activity* (A) (Osgood et al., 1957).

The evaluation factor "[…] corresponds to the individual's tendency to make an approach to the stimulus or to avoid it; it measures the extent to which the stimulus has positively or negatively reinforced the individual's responses (Carroll, 1959, p. 73-4). It thus represents such adjectival scales as good-bad, beautiful-ugly, sweet-sour, clean-dirty, pleasant-unpleasant, happy-sad, etc. (Osgood et al., 1957). The potency factor "[…] suggests a measurement of the AMOUNT of adjustment that is made or must be made to a stimulus, or […] the amount of effort which is put into the response to a stimulus." (Carroll, 1959, p. 74). It represents such adjectival scales as large-small, strong-weak, heavy-light, hard-soft, masculine-feminine, mature-youthful, etc. (Osgood et al., 1957). The activity factor "[…] refers to the necessity or nonnecessity of making movements in adjusting to stimuli." (Carroll, 1959, p. 74). It thus represents such adjectival scales as fast-slow, active-passive, hot-cold, excitable-calm, rash-cautious, heretical-orthodox, etc. (Osgood et al., 1957). Osgood et al. (1957) state that 20 concepts against 50 adjectival scales are accounted for in terms of only these three dimensions of semantic structure; evaluation, potency, and activity.

It was Osgood et al. (1957) who first applied the SD to colour as one of the many concepts in order to test the Evaluation-Potency-Activity (EPA) structure of the semantic dimensions of the affective meanings of colours (Taft, 1997). In their study, they address the question whether different colours have different meanings to different people (Osgood et al., 1957). Osgood et al. (1957) analyse the obtained data within the three factors of meaning, i.e. evaluation, potency, and activity. The results of their study on the connotative meanings of colours show that, there are no systematic effects of colours upon the evaluation factor, whereas the effects of colours upon the activity and potency factors are found to be remarkably systematic. The activity factor associates with the hue of a colour, where the colours towards the red end of the spectrum, i.e. referring to the colours red and yellow, are perceived as active, the colours towards the blue end of the spectrum, i.e. referring to the colours blue, green and violet are perceived as passive. The potency factor is found to be associated with the saturation of colours, where the more saturated colours are likely to be perceived as more potent (Osgood et al., 1957; Taft, 1997). In accordance, Osgood (1959[23]; as cited in Taft, 1997) later checked these findings by doing cross-cultural study on the connotative meanings of colours. Although Osgood et al. (1957) have not found any systematic effects of colours on the evaluation factor, Osgood (1959) find in a cross-cultural study that evaluation is related to brightness (Taft, 1997).

After the development of the SD and the usage of factor analytical solutions by Osgood et al. (1957) in their research on the measurement of meaning, a number of studies on colour affectivity and meaning have been carried out by using the semantic differential technique and the adjectival scales that are generated by Osgood et al. (1957). These colour studies are also called the factor analytic studies of the connotative meanings of colours (Wright and Rainwater, 1962). Besides the three factor solutions of Osgood et al. (1957), Wright and Rainwater (1962) categorise 48 adjective pairs into six factors, i.e. happiness, showiness, forcefulness, warmth, elegance, and calmness in a study of the connotative meanings of the isolated colour samples. Hogg (1969), on the other hand, classifies 40 bipolar adjectives into four factors in his study of single colours and colour pairs which are labelled as strength, pleasantness, warmth, and usualness. Sivik (1974a) categorises 26 adjective scales into four factors, i.e. excitement, evaluation, potency, and temperature, in his study of single colours. Sivik selects his original scales from earlier factor analytical studies of Osgood et al. (1957) and Hogg (1962). A number of studies conducted to search for the connotative meanings of isolated or single colours and extracted the factors accordingly. However, Sivik and Taft (1989) conducted a study to search for the variables of meaning for judging colour combinations and extracted five factors, i.e. general evaluation, articulation, brightness, warmth, and originality. Crozier (1996) states that the use of similar adjectival scales across different studies whether using isolated colour

[23] Osgood, C. E. (1959). The cross-cultural generality of visual-verbal synesthetic tendencies. *Behavioral Sciences, 5*, 146-169.

samples or colour combinations cause to obtain these similar dimensions of colour meaning, although different names are assigned to them.

In the studies of the isolated colours, Wright and Rainwater (1962), Hogg (1969) and Sivik (1974) have identified similar factors. Generally, the factor evaluation is similar with the factor pleasantness; the factors activity and potency are similar with the factors excitement, calmness, forcefulness and strength; and the factor warmth is similar with the factor temperature. Although, all these factors correspond to the three semantic dimensions obtained by Osgood et al. (1957), these studies introduce a fourth factor which is temperature or warmth (Taft, 1997; Taft and Sivik, 1992). Furthermore, in regard of these studies, the results of the relation between the common factors and colour dimensions show similarities particularly on the factors of activity and potency, and warmth. The activity (excitement) factor is found to be mainly related to saturation or chromaticness of a colour. The potency (forcefulness, strength) factor is found to be mainly dependent on blackness and/or lightness, in order words, value of a colour. These findings are different with the findings of Osgood et al., where the activity factor is associated with hue, the potency factor is associated with saturation or chroma. The temperature or warmth factor are found to be the primary function of hue, where the colours yellow and red are the warmest, the colours blue and green are the coolest. Moreover, these studies find that warmth increases when the colour has a higher chroma (Sivik, 1974a; Taft, 1997; Taft and Sivik, 1992).

Beyond the national studies on the connotative meanings of colours, a number of cross-national studies are conducted in order to investigate the cross-cultural generality of colour meaning and their relations to colour dimensions (Adams and Osgood, 1973; Taft and Sivik, 1991; Taft and Sivik, 1992). Even though the differences in the nationalities of the subjects; i.e. British, Croatian, Russian, Swedish and US, in these colour meaning studies of isolated colours, it is found that there exists a substantial agreement on the semantic factors and their relationships to colour dimensions (Taft, 1997).

Additionally, the extracted factors and their relations to colour dimensions vary depending on the contexts of the colour meaning studies to be investigated. For instance, Acking and Küller (1972[24]; as cited Sivik, 1974a) investigate in a study the patterns of meaning of colours in a room, they categorise five factors; personal evaluation, social evaluation, special enclosedness, complexity and unity. Sivik (1974b) classifies three factors; i.e. emotional evaluation, social evaluation and spatial factor, in a study of colour meaning of building exteriors. Hogg et al. (1979) identifies five factors, i.e. dynamism, spatial quality, emotional tone, complexity and evaluation, in a study of ratings of isolated colour chips and colours on an interior model by architects and non-architects. All of these studies point out that special enclosedness, spatial factor or spatial quality are primarily function of value or blackness of a colour but not with hue or saturation, where darker colours seem more enclosed and cramped, lighter colours seem more spacious (Crozier, 1996; Taft, 1997). The factor dynamism (activity) is associated with saturation where more saturated colours seem more dynamic, exciting and hard. The factor emotional tone (temperature) is associated with hue, where red, orange and yellow are usually perceived as warm, blue, green and violet are perceived as cold (Crozier, 1996). These studies show that there is a linear relationship between the extracted factors and colour dimensions. In sum, Crozier (1996) states that saturation and lightness of a colour is more significantly influence the connotative meanings of colour than hue.

The main approach of colour meaning is to clarify the relationships between the semantic variables of connotative meaning; i.e. beautiful-ugly, active-passive, hard-soft, warm-cool, etc. and colour dimensions; i.e. hue, lightness/value and saturation/chroma. The SD is proposed by Osgood et al. (1957) as an index of connotative aspects of meaning. Whatever the concepts or contexts to which the SD is applied to search for the connotative meanings of colours, Crozier (1996) claims that, “it is

[24] Acking, C. A. & Küller, R. (1972). The perception of an interior as a function of its colour. *Ergonomics, 6*, 645-654.

possible to identify the dimensions of colour that are associated with the different factors." (p. 69). He states further that different factors in different studies are found similar results which all have referred to the three primary factors; i.e. evaluation, potency, and activity, introduced by Osgood et al. (1957).

2.5.2 Colour Emotion

Perceiving colour is regarded as containing a higher level of subjectivity, which expresses feelings, affects, and emotions. Birren (1978[25]; as cited in Ou, 2004) points out the differences of the emotional reactions of different people to the same colour. These emotional levels of colour perception have attracted many scientists in order to characterise the emotional profiles of colour by addressing the question "why and how can emotions be evoked by colours?" (Ou, 2004, p. 37). In order for the relationship between colour and emotion to be explored, the psychological term *colour emotion* has been used by the researchers in this field of area (Light, 1988, Ou, 2004). Xin et al. (2004, p. 458) claim that "[…] the term colour emotion has been used recently to represent the aroused feelings and emotions of human beings during colour perception." Sueeprasan et al. (2005, p. 271) state that "Colour emotion is the term used to describe the feeling induced in an observer when viewing a particular colour." Ou (2004, p. 40) defines that "Colour emotion is the relationship between colour stimuli and the reactive-level emotional responses which are determined by the configurations of colour stimuli in an entire visual experience." Although there have been given different definitions to the term colour emotion, the most widely used definition is that "[…] colour emotion is the emotion evoked by colours and that it can be expresses through words." (Ou, 2004, p. 37). For instance, Levy (1984) finds that warm colours are active and arousing whereas cool colours are sedate and soothing.

The interests on the research of colour emotion are divided into two approaches. First approach is based on the studies of discrete emotions and the second approach depends on the studies of dimensional emotions (Brengman and Geuens, 2004; Akbay and Ertez Ural, 2008). Many emotion theorists have claimed that some emotions have a special status which is called basic, primary, or fundamental. Several contemporary theorists agree on the fact that some emotions are basic, although there is a little agreement on how many and which of them are basic (Ortony and Turner, 1990). Ortony and Turner (1990) state that, every theorist who postulates basic emotions on their lists include anger, happiness, sadness, and fear. However, the different theorists give name to the same emotion differently. Ortony and Turner (1990) define these differences in labelling the same emotions as follows.

> […] Some theorists use the term *anger* and the others the word *rage* while presumably referring to the same emotion; some speak *fear* whereas others speak of *anxiety*; and the same pleasant emotion may be labelled *happiness* by one author, *joy* by another, and *elation* by yet another (p. 315).

On the other hand, according to the Darwin, the basic emotions are evolved phenomena and they seem to be fundamentally universal and inherited (Oberascher and Gallmetzer, 2003; Da Pos & Green-Armytage, 2006). Ekman and Davidson (1994[26]; as cited in Oberascher and Gallmetzer, 2003) describe seven basic emotions by taking the basis of Darwin's evolutionary theory of emotions which are pleasure, surprise, anger, disgust, fear, sadness and contempt. Additionally, Ekman and Davidson (1994) propose that these basic emotions are universal and intercultural both in physiological and psychological aspects and in mimic expressions, as well (Oberascher and Gallmetzer, 2003). Da Pos and Green-Armytage (2006) state that, these seven basic emotions are external expressions which

[25] Birren, F. (1978). *Color and human response*. New York: John Wiley & Sons.

[26] Ekman, P. & Davidson, R. J. (Eds). (1994). *The nature of emotion*. New York: Oxford University Press.

seem to be independent of culture and personal experience. Da Pos and Valentini (2005, p. 263) suggest further that "[…] [people's] emotional reactions to colours should be, at least partially, rooted in the human biological substrate and therefore a more or less natural link between [basic] emotions and colours seems plausible."

In accordance, Oberascher and Gallmetzer (2003), in a survey perform with Europeans, address the question "[…] how far the postulated universality of emotions […] could be applied to the relationship between emotion and colour." (Oberascher, Oberascher and Gallmetzer, 2005, p. 213). In the study, the authors use the illustrations of the mimic expressions of the seven basic emotions of Ekman and Davidson. The results of the study show that there is a high concurrence between the basic emotions and the colours. Additionally, they suggest colour emotion classifications as emotion/colour-coding, i.e. black: sadness; yellow: pleasure; red: anger; brown: disgust, etc. (Oberascher and Gallmetzer, 2003). Then, Oberascher et al. (2005), in a survey perform with Central Europeans and West Africans; explore the question whether the emotion/colour-coding is a universal and intercultural phenomenon. The results of the study show that there exist clear differences within and between the cultural groups. Da Pos and Valentini (2005) in a survey aim to address the similar question with Oberascher and Gallmetzer (2003). They use the illustrations of the mimic expressions of the seven basic emotions and the participants are asked to paint suitable backgrounds for the faces of these basic emotions (Fridell Anter and Billger, 2010). The authors conclude similar results with Oberascher and Gallmetzer (2003) however, they find some relevant differences. The results show that the basic emotions happiness and surprise are relatively close to light colours, happiness is very yellowish; fear is bluer and redder; and sadness is less yellowish than disgust. Additionally, da Pos and Green-Armytage (2006), in a survey with Australians and Europeans, address the question whether the facial expressions of six basic emotions, i.e. anger, surprise, disgust, sadness, happiness, and fear, with colours are consistent among different cultures. The participants are asked to select the colours that fit best with the faces from the NCS (see Section 2.3.3) collection colour samples. The results point out that happiness, surprise and anger are associated with highly chromatic colours, whereas sadness and fear are associated with desaturated colours. The authors conclude that most emotions share the similar patterns of colour associations when it is compared with the previous European studies with this Australian research (Da Pos and Green-Armytage, 2006, 2007). In sum, the discrete approach is used as an emotional term in colour emotion in order to employ the basic levels of emotions, questioning whether they are universal and intercultural, and their relations to colours.

Another research approach within colour emotion deals with the dimensions of emotions and their relations to colour dimensions, i.e. hue, lightness/value, and saturation/chroma (see Section 2.2). Following Osgood et al.'s (1957) categorisation of the three factors of meaning; evaluation, potency, and activity, Mehrabian and Russell (1974[27]; as cited in Valdez, 1993) suggest that these three dimensions of meaning are in accord with the three fundamental emotion states which are *Pleasure* (P), *Arousal* (A), and *Dominance* (D) (hereinafter PAD). In other words, Mehrabian (1996) claims that emotions and social cues can be described by using the same and similar sets of the three semantic differential factors introduced by Osgood et al. (1957). Mehrabian's pleasure-arousal-dominance instrument is a later adaptation of Osgood's evaluation-potency-activity instrument. The major claim of PAD instrument is that, the emotional states of all types of stimuli are best described and differentiated by these three dimensions (Suk, 2006).

The first state of emotion, which is the State Pleasure-displeasure, is defined as positive versus negative affective states, including the states of excitement, relation, love and tranquillity versus cruelty, humiliation, disinterest, and boredom. It corresponds with the cognitive judgements of evaluation and this evaluation associates with greater pleasure induced by the stimuli (Mehrabian, 1996). It is the emotional counterpart of Osgood et al.'s (1957) evaluation factor (Valdez and Mehrabian, 1994). The second state of emotion, which is the State Arousal-nonarousal, is defined as

[27] Mehrabian, A., & Russell, J. A. (1974). *An approach to environmental psychology*. Cambridge: MIT Press.

the level of mental alertness and physical activity, including the lower end of sleep, inactivity, boredom, and relaxation versus the higher end of wakefulness, bodily tension, strenuous exercise, and concentration (Mehrabian, 1996). Feldman (1995[28]; cited in Feldman Barrett, 1998) defines arousal as a subjective feeling activated or deactivated. It is the emotional correlate of Osgood et al.'s (1957) activity factor (Valdez and Mehrabian, 1994). The third state of emotion, which is the State Dominance-submissiveness, is defined as "[…] a feeling of control and influence over one's surroundings and others versus feeling controlled or influenced by situations and others, [including the states of] […] anger, relaxation, power, and boldness versus anxiety, infatuation, fear, and loneliness." (Mehrabian, 1996, p. 263). It is the converse of Osgood et al.'s (1957) potency factor (Valdez and Mehrabian, 1994). Mehrabian (1996) asserts that, the emotional state of dominance appears much weaker than the other two states of emotions and it is positively related with the emotional state of pleasure. The emotional dimension of dominance, generally, has not been taken into consideration in some of the emotion studies, although it is agreed on Osgood et al.'s (1957) three dimensional meaning space. Shaver et al. (1987[29]; as cited in Suk, 2006) claims that the three-dimensional representation of affect is more informative than the two-dimensional one and all three dimensions necessary for a sufficient descriptions of emotions.

The PAD emotion scale is a set of self-report scales developed by Mehrabian in 1974 and 1978. The three-dimensional approach of PAD emotion scales utilises factor analysis to organise emotions through the semantic differential. The major aim of the PAD emotion scale is to calculate participants' rating scores on the dimensions-pleasure, arousal, and dominance-affect. It consists of 34 items in semantic differential questionnaire. The scales include a 16-item 'pleasure-displeasure' scale (eight positively and eight negatively worded items), a 9-item 'arousal-nonarousal' scale (four positively and five negatively worded items), and a 9-item 'dominance-submissiveness' scale (four positively and five negatively worded items) (Mehrabian, PAD; Mehrabian, 1996).

It was Valdez and Mehrabian (1994) who first employed PAD scales in order to assess the individuals' emotional responses to colours. The results of the aforementioned study indicate that bright colours have a stronger effect than saturated colours on pleasure; less bright and more saturated colours are more arousing and they induce greater feelings of dominance. In addition to Valdez and Mehrabian (1994), Brengman and Geuens (2004) and Bamford and Nobbs (2007) employ PAD scales in their studies on colour emotions. In regard of the results of the study of Brengman and Geuens (2004) that, when the dominance dimension is compared with the results of the dimensions pleasure and arousal, it has low validity and reliability. Russell and Pratt (1980) and Bergman and Geuens (2004) suggest that the dimension of dominance should be ignored for colour emotion studies. The reason for this is that, the dominance dimension is not applicable to assess individuals' emotional responses to colours.

Besides the PAD emotional scales, a number of studies on colour emotion have been carried out by using the semantic differential rating scales of Osgood et al. (1957) and the factor-analytical solutions. Kobayashi (1981[30]; as cited in Ou et al., 2004a), for instance, develops three main dimensions of colour emotion in a study of colour image scale, i.e. warm-cool, soft-hard, and clear-greyish. Sato et al. (2000[31]; as cited in Ou et al., 2004a) later identify Kobayashi's (1981) colour emotion dimensions as warm-cool, potency, and activity which are in accord with the basis of colour appearance attributes, i.e. hue, lightness and chroma, respectively. With respect to the results of the

[28] Feldman, L. A. (1995). Valence-focus and arousal-focus: Individual differences in the structure of affective experience. *Journal of Personality and Social Psychology*, *69*, 153-166.

[29] Shaver, P., Schwartz, J., Kirson, D., & O'Connor, C. (1987). Emotion knowledge: further exploration of a prototype approach. *Journal of Personality and Social Psychology, 52*(6), 1061-1086.

[30] Kobayashi, S. (1981). The aim and method of the color image scale. *Color Research and Application, 6*, 93-107.

[31] Sato, T., Kajiwara, K., Hoshino, H., & Nakamura, T. (2000). Quantitative evaluation and categorising of human emotion induced by colour. *Advances in Colour Science and Technology, 3*, 53-59.

studies mentioned, Gao and Xin (2006) conclude that "[…] the […] [affectivity] of a colour comes mainly from its lightness and chroma and to less extent from its hue with an exception for the "warm-cool" pair, which is dependent mainly on hue." (p. 412). Besides the national studies on colour emotion, Ou et al. (2004a) carry out a psychophysical experiment with British and Chinese observers in order to classify colour emotions for single colours and to develop colour-science-based colour emotion models. By using factor analysis, the study mentioned identifies three colour-emotion factors; i.e. colour activity, colour weight, and colour heat. Ou et al. (2004a) conclude that the three factors are agreed well with those of the findings by Kobayashi (1981) and Sato et al. (2000). Four colour-emotion models, furthermore, are developed by Ou et al. (2004a) and in regard of the results of the study, it is suggested that the four colour emotions, i.e. warm-cool, heavy-light, active-passive, and hard-soft, are culture-independent across different nationalities. In accordance, the results of the aforesaid study show that the colour emotion warm-cool is connected with colour heat, hue angle and chroma. While the colour emotion heavy-light is connected with lightness only, the colour emotion hard-soft is connected with both lightness and chroma. Later, Ou et al. (2005) carry out a psychophysical experiment with the observers in six different countries, i.e. British, Chinese, French, German, Spanish and Sweden, to address the question whether cultures have an influence on viewers' emotional responses to single colours and colour pairs. The results of the aforesaid study show that there are little cultural effects on the emotional responses to single colours and to colour pairs across the countries. In addition to Ou et al. (2004a), Gao and Xin (2006), in a study, define colour emotion by classifying three indexes namely activity, potency, and definition. The authors of the aforementioned study conclude that the emotional connotation of a colour is mainly associated with lightness and chroma.

The main approach of colour emotion is to investigate the relationship between the semantic variables of emotion and the single colours or colour pairs. Colour emotion is considered as a new-born research area. This research area continues to develop its theories and methodologies with a group of researchers from different disciplines including colour sciences, psychology, architecture, and product design (Ou, 2004).

CHAPTER 3

METHODOLOGICAL BACKGROUND OF THE RESEARCH

3.1 Personal Construct Psychology

The psychology of personal constructs is based on a theory, called personal construct theory, which was originally developed by George Kelly in 1955. Personal construct theory in general is interested in people and the way of their interpretations of the world around them (Beail, 1985; Osbourn, 1988). The basis of personal construct theory depends on the implementation of philosophical assumption (Bannister and Fransella, 1986) as Kelly stated "every man his own scientist" (Fransella and Bannister, 1977, p. 4). This assumption means that each person has his/her own personal ideas, philosophies and theories about the world. On the basis of person's theories[32], each person develops hypotheses according to his/her own expectations to make sense of their experiences and behaves with his/her personally organised system of interpretations of experienced events (Beail, 1985; Bannister and Fransella, 1986). Thus personal construct theory is concerned with these interpretations and the ways in which they are organised and interconnected in people's personal construct system (Osbourn, 1988).

In terms of construct system, people make sense of their worlds and the events in them through construing and re-construing. In his assumption, Kelly (1955; as qtd in Caputi, Foster and Viney, 2006, p. xiii) stated that "all of our present interpretations of the universe are subject to revision or replacement" which is called *constructive alternativism* (Bannister and Fransella, 1986). According to constructive alternativism, people are not limited to interpret their world around them; they can re-interpret and make ways for alternatives of construing their world (Caputi et al., 2006).

Personal construct theory is presented in a formal form as fundamental postulate of the psychology of personal constructs and defined by means of eleven elaborative corollaries (Osbourn, 1988). In order to understand the psychology behind the personal construct theory, the fundamental postulate and its corollaries need to be described. Only the three out of eleven corollaries are seen as significant to discuss in terms of the purpose of this thesis. The other eight corollaries with their definitions are given in Appendix A. The three corollaries that are discussed in the course of this section are; i. construction corollary, ii. individuality corollary, and iii. commonality corollary.

Kelly (1955/1991) defines a fundamental postulate for the psychology of personal constructs as follows; "a person's processes are psychologically channelized by the ways in which he anticipates events." (p. 32). This statement gives reference to the assumptions of constructive alternativism. This fundamental postulate is elaborated by defining the following corollaries.

Construction Corollary. Kelly (1955/1991) defines construction corollary as follows; "A person anticipates events by construing their replications." (p. 35). This corollary underlies that people make sense of their world and live by not only continual detection of repeated themes but also

[32] Fransella and Bannister (1977, p. 2) defines a person's theories as follows;

> A person's theories, [i.e.] his personal construct system, might be referred to in other psychological approaches as his "personality", his "attitudes", his "habits", his "reinforcement history", his "information coding system", his "psychodynamics", his "concepts", his "philosophy" or his "central nervous system".

categorising of these themes and segmenting their world in terms of them. For instance, the dinner that was eaten yesterday is not the same dinner as that eaten today. However, people's use of the construct *dinner* is an explicit construing of its replication (Bannister and Fransella, 1986). This corollary introduces the notion of construing. The term construing is defined as "[…] placing an interpretation: a person places an interpretation upon what is construed." (Kelly, 1955/1991, p. 35). Kelly (1955/1991, p. 35) describes the term construing further by saying;

> In construing, the person notes features in a series of elements which characterise some of the elements [that] are particularly uncharacteristic of others. Thus he erects constructs of similarity and contrast. Both the similarity and contrast are inherent in the same construct. […] Construing is not to be confounded with verbal formulation. A person's behaviour may be based upon many interlocking equivalence-difference patterns which are never communicated in symbolic speech.

The construing of the world or events consist of similarities and contrasts between past and present experiences which are essential characteristics of the construal process. This construal process elicits constructs to compare people, things or events (Osbourn, 1988). Kelly (1955; as qtd in Fransella and Bannister, 1977, p. 3) therefore describes a construct in the following terms.

> A construct is like a reference axis, a basic dimension of appraisal, often unverbalised, frequently unsymbolised, and occasionally unsignified in any manner except by the elemental processes it governs. Behaviourally it can be regarded as an open channel of movement, and the system of constructs provides each man with his own personal network of action pathways, serving both to limit his movements and to open up to him passages of freedom which otherwise would be psychologically non-existent.

A construct is considered as a discrimination which a person can make rather than a simply verbal label. A construct is people's way of distinguishing similarity from difference (Fransella and Bannister, 1977; Beail, 1985). Bannister and Mair (1968[33]; as qtd. in Osbourn, 1988) thus define a construct as the "[…] way in which some things are seen as being alike and yet different from others" (p. 197). Fallman and Waterworth (2005) define a construct as "[it is] a single dimension of meaning for a person allowing two phenomena to be seen as similar and thereby as different from a third." (p. 1). Kelly argues that personal construct systems are organised systems which are being made up of hierarchically linked, related, and integrated sets of bipolar constructs and composed of similarity-dissimilarity dimensions, such as here-there, ugly-beautiful, light-heavy, and etc. (Fransella and Bannister, 1977; Beail, 1985). Kelly argues that it is necessary to have constructs with two poles because both poles of a construct are not always available. However, the emergent pole that is stated can only exist by comparing with its implicit or unlabelled pole (Bannister and Fransella, 1986; Osbourn, 1988).

Individuality Corollary. Kelly (1955/1991) defines individuality corollary as follows; "Persons differ from each other in their construction of events." (p. 38). Since the fundamental postulate of the psychology of personal constructs gives emphasis on the ways in which a person anticipates events, this assumption provides a psychology of individual differences (Kelly, 1955/1991). Kelly (1955/1991) states that "people can be seen as differing from each other, not only because there may have been differences in the events which they have sought to anticipate, but also because there are different approaches to the anticipation of the same events." (p. 38). This corollary implies that not only each person has a unique repertory of bipolar personal constructs to construe and anticipate his or her experience of events but also "[…] each of […] constructs is embedded in a personal context of meaning defined in part by its relationships of implication with other constructs." (Adams-Webber,

[33] Bannister, D. & Mair, J. M. M. (1968). *The evaluation of personal constructs.* London. Academic Press.

2003, p. 52). Additionally, Ryle (1975[34]; as qtd. in Osbourn, 1988, p. 197) believes that this individuality corollary would be supported by stating; "persons resemble to each other in their construction of events" which commonality corollary covers this statement.

Commonality Corollary. Kelly (1955/1991, p. 63) defines commonality corollary as follows; "To the extent that one person employs a construction of experience which is similar to that employed by another, his psychological processes are similar to those of the other person." This corollary provides for the comparison between people, yet it seems like opposite for the individuality corollary (Fransella and Bannister, 1977; Osbourn, 1988). However, Kelly (1955/1991, p. 63) clarifies the commonality corollary as follows;

> If a person's processes are psychologically channelized by the ways in which he anticipates events [fundamental postulate], and if he anticipates events by construing their replications [construction corollary], it may seem obvious that we are assuming that, if two persons employed the same construction of experience, their psychological processes would have to duplicate each other.

In other words, the individuality corollary implies that people frequently use different constructs to interpret the same events; however, the commonality corollary indicates that any two people can develop personal construct system with the same pattern in the implication of the relationships between constructs (Adams-Webber, 2003). For instance, Duck (1973[35], as cited in Adams-Webber, 2003) has demonstrated in a series of studies that friends show more similarity than pairs of individuals who are not friends in terms of their elicited personal constructs. Fransella and Bannister (1977) claim that two people may appear to be construing in a similar way, however, in the lines of implication of these constructs for the two people may occur differently. Fransella and Bannister (1977) state further by saying that these differences can also be observed in a group level.

The psychology of personal constructs is based on the theory of personal constructs which is defined by fundamental postulate and its corollaries. All eleven corollaries are significant to understand the psychology behind Kelly's personal construct theory; however, only three of them are described briefly in terms of the scope of this thesis. It is also important to be noted that people's personal construct system is composed of a finite number of bipolar constructs. They are not only linked and related with a complex hierarchical structure but also integrated into the system with many subsystems. A person's construct system is interrelated in a hierarchy of superordination and subordination. Superordinate constructs tend to be more permanent and important to the person than subordinate ones. However, these are well-ordered in people's personal construct system in order to control their interpersonal world and they give guidelines for living (Beail, 1985; Bannister and Fransella, 1986; Osbourn, 1988) (see Appendix A).

Kelly's personal construct theory provides a systematic language for describing construing processes of people by giving emphasis on the idea of bipolarity in constructs. Kelly believes that this bipolarity allows people to visualise a variety of the relationships between constructs. Thus in order to measure the variety of people's personal construct systems, Kelly developed a method to obtain the mathematical relationships between constructs through his so-called *repertory grid technique* (Bannister and Fransella, 1986).

[34] Ryle, A. (1975). *Frames and cages: The repertory grid approach to human understanding.* Sussex University Press.

[35] Duck, S.W. (1973). *Personal relationships and personal constructs*. New York: John Wiley & Sons.

3.2 Repertory Grid Technique

Kelly originally called 'Role Construct Repertory Test' and it soon became known as the 'Repertory Grid' technique (Bell, 2003). Repertory grid technique (hereinafter RGT) is the practical application and methodological component of personal construct theory which is said to be based on Kelly's fundamental postulate (Beail, 1985; Osbourn, 1988; Bell, 2003). The fundamental postulate says that "a person's processes are psychologically channelized by the ways in which he anticipates events" (Kelly, 1955/1991, p. 32). This statement supports the repertory grid by considering the *ways* are the constructs and the *events* are the elements. Briefly, as Bell (2003) states "the technique of the repertory grid thus involves defining a set of elements, eliciting a set of constructs that distinguish among these elements, and relating elements to constructs." (p. 95).

Kelly developed the grid as a method for exploring the structure and content of personal construct systems. Using the idea of bipolarity in a grid, allows eliciting personal constructs and the way of examining the relationships between them within a specific domain (Beail, 1985; Osbourn, 1988; Feixas and Cornejo-Alvarez, 2002). Bannister and Mair (1968; as qtd. in Osbourn, 1988) define a repertory grid as, "Any form of sorting task which allows for the assessment of relationships which yields these primary data in matrix form." (p. 215). The grid therefore represents a two-dimensional matrix which is usually generated by a single individual. In other words, it can be said that the grid is a table of cases by variables data matrix, columns of which represent elements as cases and rows of which contain constructs as variables. Generally, the repertory grid is a structured procedure which aims at reserving for matrices of the repertoire of the elicited constructs from individuals and exploring their interrelations (Leach, 1980; Osbourn, 1988; Feixas and Cornejo-Alvarez, 2002; Fallman and Waterworth, 2005).

It is a flexible methodology which makes it applicable to a wide variety of contexts and purposes to explore people's idiosyncratic[36] construction processes. The grid should be in any form however it has to be consisted of three parameters for its application, i.e. a series of *elements* that are representatives of the area under study, a set of *personal constructs* that are used to compare these elements, and a *rating system* that is used to link the elements to constructs (Feixas and Cornejo-Alvarez, 2002). These three parameters are discussed briefly as follows.

Elements. Kelly (1955/1991, p. 95) defines elements that are used in the RGT as "The things or events which are abstracted by a construct […]." In the RGT, the elements determine the focus of a grid. They are the objects or events to which judgement is applied and selected depending on the area in which construing is to be evaluated (Osbourn, 1988; Feixas and Cornejo-Alvarez, 2002). The elements in a grid are either obtained by discussion between the investigator and the respondent in a study or pre-selected by the investigator. In the clinical field, elements are usually people or the role descriptions (i.e. your mother, employer, best friend), however Janckowicz (2004) claims that elements can be anything such as events, things, objects, products, images, works of art, surface counters like colour, texture and etc. Easterby-Smith (1980) states that there are two general points for the specifications of the elements. Firstly, they should be homogenous and drawn from the same category of things or events. Secondly, they should be representative of the area to be investigated and they should lie within the same range of convenience of interest. He goes further in suggesting that the use of no more than twelve elements in a study is adequate of the chosen topic.

Constructs. Kelly (1955/1991, p. 41) as states in his Dichotomy Corollary (see Appendix A) that, "A person's construction system is composed of a finite number of dichotomous constructs" which gives emphasis to the idea that constructs are bipolar. Constructs are the tools which are used to define individuals' ways of distinguishing similarities in and differences between a set of elements (Osbourn, 1988) (see Section 2.6). For the elicitation of personal constructs, there is a variety of structured procedures for generating constructs in a grid. However, a decision should be taken

[36] Oxford dictionary defines *idiosyncrasy* as "a mode of behaviour or way of thought peculiar to an individual." (Oxford Dictionaries, 2012, n.p.).

whether previously selected constructs are used in a grid relevant to the the area under study or personal constructs are elicited directly from the subject (Feixas and Cornejo-Alvarez, 2002). Easterby-Smith (1980) claims that the quickest way of producing constructs are to supply them while the research is nomothetic[37] in character. In this procedure, the grid is being used as a Semantic Differential devised by Osgood, Suci and Tannenbaum (1957) rather than asking the subject to differentiate between the elements in his/her own terms or descriptions. Although this approach is useful in some situations, Adams-Weber (1979[38]; as qtd. in Osbourn, 1988, p. 220) claims that "there is […] considerable evidence that the constructs which are elicited from the subject individually are more personally meaningful to the subject than are supplied to them from other resources." In accordance, Feixas and Cornejo-Alvarez (2002) states that the focus of the grid is idiographic because this approach gives a more precise picture of a subject's decisions about the elements. Kelly (1955/1991, as cited in Fransella et al., 2004) originally outlined six procedures for the elicitations of personal constructs in clinical psychology, nevertheless, the elicitation procedures of personal constructs which are in the scope of this thesis are discussed in the following.

a. Triadic Elicitation Procedure. The classical procedure for generating constructs is to elicit them by means of *triads*. This procedure, is first proposed by Kelly, involves presenting three elements (triads) at a time from the full list of elements and asking the respondent to say "[…] in what way two of the elements are *alike* [and thereby different from a third element] and in what way the third element is *different* from the other two." (Easterby-Smith, 1980, p. 6). The result of each triad is the list of personal constructs with two contrasting or opposing poles. The procedure continues with presenting successive triads until the respondent unwilling to elicit novel constructs (Yorke, 1978). Easterby-Smith (1980) states that, successive triads should be chosen randomly or by the investigator because the selection of triads may affect the final result of a grid.

b. Dyadic Elicitation Procedure. The alternative way of generating constructs is to elicit them by means of using pair of elements, or in other words *dyads*, although the triadic procedure has been widely used to elicit constructs (Yorke, 1978). This procedure is recommended by Yorke (1985[39], as cited in Feixas and Cornejo-Alvarez, 2002) because it is more likely to elicit clear opposite poles. The dyadic procedure is based on selecting and presenting two elements (dyads) at a time from the full list elements and asking the respondent to say "[…] whether they are alike or different, and what it is that makes them alike or different." (Easterby-Smith, 1980, p. 7). Again, the result of each dyad is the list of bipolar personal constructs. The procedure continues with presenting successive dyads. Easterby-Smith (1980) claims that, the use of dyadic elicitation procedure is more common when the elements are complex. Yorke (1985; as cited in Osbourn, 1988) points out that dyadic elicitation procedure is consistent with Personal Construct Theory and easier to apply.

c. Laddering and Pyramiding Procedures. The final procedures for construct generations are known as *laddering* and *pyramiding*. These procedures are used in combination either with triadic or dyadic methods. The laddering procedure is used to elicit superordinate constructs which has been described by Hinkle (1965[40]; as cited in Fransella et al., 2004). After eliciting constructs in the usual manner, i.e. either using triading or dyading, and then asking the respondents to say which of the pole of the construct are important and preferred to them. Then it involves asking 'Why?' and the

[37] Oxford dictionary defines *nomothetic* as "relating to the study or discovery of general scientific laws." (Oxford Dictionaries, 2012, n.p.).

[38] Adams-Weber, J. (1979). *Personal construct theory concepts and applications*. London: Wiley.

[39] Yorke, D. M. (1985). Administration, analysis and assumption: Some aspects of validity. In N. Beail (Ed.), *Repertory grid technique and personal constructs: Applications in clinical and educational Settings*. London: Croom Helm Ltd.

[40] Hinkle, D.N. (1965). *The change of personal constructs from the viewpoint of a theory of implications.* Unpublished PhD thesis, Ohio State University, Columbus, OH.

question is repeated to each new construct until the respondent unable to produce new constructs. The pyramiding procedure, on the other hand, is designed to elicit subordinate or concrete personal constructs which has been described by Landfield (1971[41]; as cited in Fransella et al., 2004). Again, after eliciting constructs in standard way, i.e. either using triading or dyading, this involves asking the respondents 'What?' This helps to define in more detailed characteristics of the respondents' elicited constructs (Marsden and Littler, 2000). Both methods have been used as part of the interviewing procedure in the RGT which support to elicit more detailed, concrete and specific constructs. While Hinkle's laddering is for taking the respondents 'up' a ladder, Landfield's pyramiding is for taking the respondents 'down' it (Fransella et al., 2004). It is important to be noted that these procedures were developed for the clinical psychology; therefore they were adapted to be used in the interviewing procedure of this research (see Section 4.10.4).

Rating System. The rating system which is employed in RGT is used as a linking mechanism to define how each element relates to each element. Jankowicz (2004) states that, the meanings are expressed both by using the words and the numbers in the RGT because a construct is a dimension through which meaning can be expressed and a number is the way of charactering the elements with respect to that dimension. The rating system is the way to reveal in which the elicited constructs are in relation to the elements because it exposes the meaning underlying the labels that is given to each pole of the constructs (Easterby-Smith, 1980). In order to indicate the relationship between elements and constructs, some kinds of rating systems are used in grids which are discussed briefly as follows.

a. Dichotomous Scoring. It is Kelly's original format, which requires to the respondent to place a tick where the element is closest to the left pole of the construct or a cross where the element is closest to the right pole of the construct (Easterby-Smith, 1980; Beail, 1985). Thus the matrix of a grid consists of a number of ticks and crosses. This type of rating system is seen as a rating scale with only 2-points which is called dichotomous scale. Easterby-Smith (1980) claims that the usage of the dichotomous scale in the studies is useful when the grid data is analysed by hand. However, the distributions of the scoring in a grid have a possibility to be lopsided or skewed which means one pole of the construct is considerably used more than the other pole of the construct. Moreover, the dichotomising does not allow finer discriminations between the two poles of the construct (Beail, 1985). Slater (1977[42]; as cited in Osbourn, 1988) recommends the use of either ranking or rating scale instead of dichotomous scoring as a rating system in a grid.

b. Rank Order. Ranking scale provides much greater discriminations to be made amongst the elements than the dichotomous scoring (Beail, 1985). It is first described by Bannister (1963[43]; as cited in Fransella et al., 2004) to be used as an alternative method in order to avoid the problem of lopsidedness and skewedness of the ratings of the constructs. Ranking requires to the respondent to place the elements in order between the two contrast poles of the constructs. However, the use of ranking becomes difficult to place the elements in order when many elements are used in a grid (Beail, 1985; Osbourn, 1988).

c. Rating Scale. Beail (1985) states that rating scales are the most popular types of rating systems in the RGT. Shaw (1980[44]; as cited in Osbourn, 1988) points out that about 70% of the published studies have been using this rating system. In this method, each element is rated on a scale, i.e. generally 5

[41] Landfield, A.W. (1971). *Personal construct systems in psychotherapy.* Chicago: Rand McNally.

[42] Slater, P. (1977). *The measurement of intrapersonal space by grid technique, volume two: Dimensions of intrapersonal space*. London: Wiley.

[43] Bannister, D. (1963). The genesis of schizophrenic thought disorder: A serial invalidation hypothesis. *British Journal of Psychiatry, 109*, 680-686.

[44] Shaw, M. L. G. (1980). *On becoming a personal scientist*. London: Academic.

or 7 points, which is defined by the two contrast poles of each construct in turn. The points on the scale indicate the equal gradations between the two poles of the construct (Easterby-Smith, 1980; Beail, 1985). Fransella et al. (2004) states that, the most commonly used rating scale has been the 7-point rating scale because it allows to be made finer discriminations. A rating of 1 relates to the left-hand pole and a rating of 7 relates to the right-hand pole of the construct of the grid. The advantage of using the rating scales in a grid is that "[…] they provide an opportunity to check whether the elements really are in the *range of convenience* of the constructs—and thus if the grid has been constructed correctly." (Easterby-Smith, 1980, p. 10).

Although the RGT was developed by George Kelly in 1955 as an application of the Personal Construct Theory (PCT), which has been widely applied in clinical psychology and psychotherapy (Tomico et al., 2009), it is adopted by various disciplines, such as the field of Human Computer Interaction (HCI) and market research, particularly consumer research (Hassenzahl and Wessler 2000). The utilisation of the RGT has become popular in these areas of research in order to explore the affective qualities of the relationship between users and artefacts and to examine the similarities and the differences of consumers' perceptions of products and services (Fallman and Waterworth, 2005).

CHAPTER 4

THE EXPERIMENT AND RESEARCH METHOD

4.1 Aim and Objectives

The major aim of the thesis is to explore the attitudinal approaches of individuals towards perceived colours. This thesis intends as a first step towards eliciting idiosyncratic/personal attitudes, judgements and interpretations of individuals towards perceived colours by utilising the Repertory Grid Technique (hereinafter RGT). It is revealed that there is an obvious absence in colour literature to describe the ways in which individuals think of/give meanings to the colours in their own words. The statement 'in their own words' establishes the main approach of this research and the study is thus conducted for the purpose of determining the individuals' ways of construing perceived colours verbally accordingly.

For the first step, the objectives of the research include:

- to elicit idiosyncratic/personal attitudes of each individual in construing the perceived colours in his/her own words;
- to explore the interpersonal relations of the common attitudes towards perceived colours that the individuals mostly verbalise;

The objectives above are based on investigating the elicited idiosyncratic attitudes towards perceived colours of each individual. Each individual uses his/her idiosyncratic attitudes in order to distinguish between the colours that he/she perceives; therefore it is important to understand which perceived colours are particularly differentiated by which elicited attitudes of individuals. By doing this, the colours that are utilised to be distinguished by individuals for eliciting attitudes towards these perceived colours gain meaning to be described. In other words, the relatedness or similarity of the colours that the individuals perceive can be described by the elicited idiosyncratic attitudes of individuals accordingly.

In accordance, this thesis intends as a second step towards exploring the structure and the interrelations between the common elicited attitudes of individuals and the perceived colours.

For the second step, the objectives of the research include:

- to explore the underlying factors of the common attitudes of individuals and their relatedness among the perceived colours; and
- to investigate the relationship between the common attitudes of individuals and the perceived colours.

4.2 Research Questions

Through the course of this study, the following two main questions are dealt with;

1. How do individuals think of/give meanings to/construe the perceived colours in their own words?

2. How are individuals' attitudes and the perceived colours related?

With the utilisation of the RGT, it is expected to find out the answers of the above mentioned questions. The study is based upon data-driven approaches because it is explorative in nature. Table 4.1 outlines the aims and objectives of the study, and research questions, accordingly.

Table 4.1 Outline of the aims, objectives and research questions of the study

AIM	OBJECTIVE	RESEARCH QUESTION
1. EXPLORATION OF THE ATTITUDINAL APPROACHES OF INDIVIDUALS TOWARDS PERCEIVED COLOURS		
Eliciting idiosyncratic attitudes, judgements and evaluations of individuals towards their perceived colours by utilising the Repertory Grid Technique.	▪ elicit personal/idiosyncratic attitudes of each individual in construing the perceived colours by his/her own words; ▪ explore the interpersonal relations of the common attitudes towards perceived colours that the individuals mostly verbalise;	How do individuals think of/give meanings to/construe the perceived colours in their own words?
2. EXAMINATION OF THE INTERRELATIONS BETWEEN THE ELICITED ATTITUDES OF INDIVIDUALS AND THE PERCEIVED COLOURS		
Exploring the interrelations between the elicited personal attitudes of individuals and the perceived colours.	▪ examine the underlying factors of the common attitudes of individuals and their relatedness among the perceived colours ; ▪ investigate the relationship between the common attitudes of individuals and the perceived colours.	How are individuals' attitudes and the perceived colours related?

4.3 Research Approach

The research approach of the study is based on the utilisation of the RGT to explore individuals' attitudes by eliciting their idiosyncratic views towards colours. Any adaptation of the RGT has not been found in the literature of the field of colour research; hence the utilisation of the RGT would therefore make this research a first in terms of its methodical approach. It is believed that this methodical approach reveals individuals' idiosyncratic/personal attitudes towards colours, by doing this; the similarities between the elicited idiosyncratic attitudes of each individual and/or their relatedness among the perceived colours can be clarified and described, accordingly. This makes the

study an exploratory study because the study is mainly based on the exploration of these approaches. However, the study includes the application of experimental research type because the elicited data resulting from the planned experiment. This means the researcher manipulates the variables under highly controlled conditions to discover the cause and effect relationship between the independent and dependent variables in the experiment. Basically, the study is about the independent variables and the results of the study or the data are the dependent variables. In this case, the independent variables are the perceived colours and the dependent variables are the elicited idiosyncratic attitudes of individuals. The study that is conducted hereinafter will be referred to as *the experiment* throughout this research.

Although the experimental research type studies primarily quantitative, the RGT is both qualitative and quantitative in nature which quantifies the qualitative insights of the individuals' idiosyncratic attitudes. Hence the study is undertaken as the mixture of both research perspectives during the progression of the study.

4.4 Experimental Set-Up

The experiment was conducted in an office in Middle East Technical University (METU) Faculty of Architecture. The office is approximately 13 m^2 and has one window. For the experiment, the window was blinded to block the natural light. This was to control daylight and create a darkened experiment room. The office that was utilised for the study hereinafter will be referred to as *the experiment room* throughout this research. Figure 4.1 shows the schematic plan drawing of the experiment room.

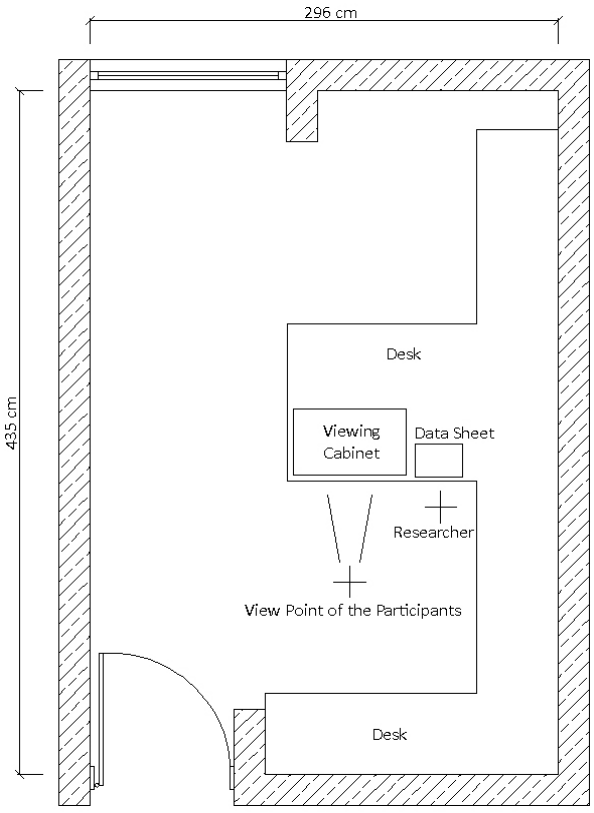

Figure 4.1 Schematic plan of the experiment room

The experiment was carried out with the utilization of the viewing cabinet that was situated within this experiment room. The viewing cabinet was designed in the form of a rectangular prism. Table 4.2 displays the specifications of the viewing cabinet for 60 cm fluorescent lamp.

Table 4.2 The specifications of the viewing cabinet

Dimensions (mm)	**Width**	**Height**	**Depth**
Overall	710	545	420
Viewing Area	674	405	402

The main purpose for designing a viewing cabinet was to create a reliable viewing condition for colours to be perceived under a consistent light[45]. The dimensions of the viewing cabinet were determined considering this cabinet is to be used for the viewing of A6 size colour samples. The viewing cabinet thus consisted of five surfaces: top, bottom, back, and two sides. The viewing areas, i.e. inner surfaces, were painted with medium grey (NCS S 4000-N) colour that corresponds to the uniform grey of *L** of 50 (see Section 2.3.1); and the GretagMacbeth[46] D65 simulator (No: F20T12/65) (see Section 2.3.1) was placed at the centre of the inner top surface for the illumination of the cabinet. Besides, a portable colour holder display was designed in 45° angle to the light source (Taft and Sivik, 1992) to minimise glare while the colour samples were presented in the cabinet during the experiment (see Figure 4.2).

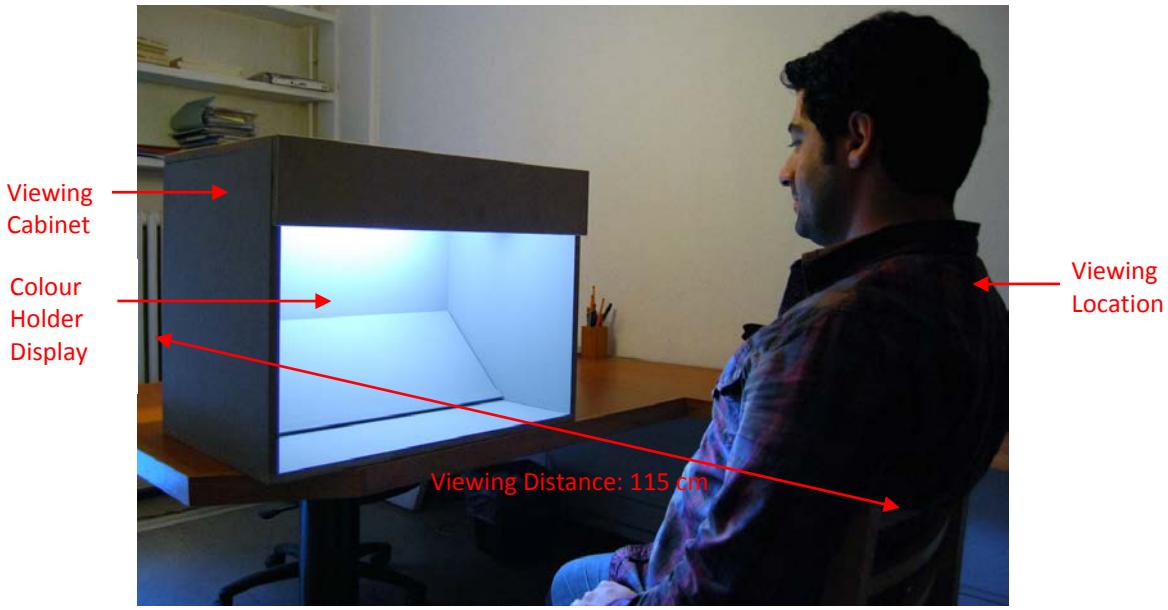

Figure 4.2 Location of the viewing cabinet, the viewing distance and location of the participants

[45] Daylight can produce discomfort shadows, patterns and glares due to the daily and seasonal movements of the sun (IESNA, 2000). North light, on the other hand, with the same season and the same time of the day prevents these discomfort effects of the sun. Since the experiment room that is utilised for the study faces east, consistent light is needed to prevent the unexpected effects during the perception of colours because these effects can cause to perceive colours differently.

[46] GretagMacbeth is the brand name of the D65 simulator which is the product of Xrite®, Incorporated.

The standard viewing distance of the participants was set as 115 cm. This viewing distance was based on the result of the pilot study that was conducted before the experiment. In the pilot study (see Section 4.10.1.1), the participants were asked to locate their viewing distance to the viewing cabinet according to their comfort in perceiving the colour samples only the condition of facing them directly. Each participant's viewing distance to the colour samples were measured from the outer back surface of the viewing cabinet to the back edge of the chair that the participants seated. The average number of distances that were determined from the six participants was 115 cm, ranging from 100 to 122 cm. As a result, the average of the distances that was determined in the pilot study was specified as the standard viewing distance for the experiment.

4.5 Apparatuses

Some tools and equipment were utilised for particular purposes for the experiment. They are listed in the following.

- Random number generator of Microsoft Excel was applied to select eight basic colours randomly from the set of each basic colour term from the study of Şahin Ekici et al.'s (2006) research (see Section 4.7.1).

- NCS-Munsell Translation Key[47] (1997) was used to translate the Munsell notations of the basic colours into Natural Colour System (NCS) notations. The language of colour communication of this research is NCS, therefore the Munsell notations of Şahin Ekici et al.'s (2006) research were translated into NCS notations (see Section 4.7.1).

- NCS Colour Scan 2.0[48] was used to measure the CIELAB specifications of eleven basic colours (see Table 4.4).

- Random sequence generator[49] was performed to select random dyads from eleven basic colours during the elicitation procedures of personal attitudes. This was to create random dyads in sets to be utilised for the experiment. A set of dyad consists of two colours where each of the eleven colours has the equal probability to appear in dyads. However, one colour in a set does not have to occur more than once because each basic colour term has only one correspondence during the experiment. Subsequently, a dyad of colours should be different in sequence and statistically independent of each other. That is why random sequence generator was utilised to create the sets of dyads of colours for the experiment (see Section 4.10.4).

- Pre-formatted grid data sheet (see Figure 4.6) was utilised for each participant separately for both noting down the polar poles of the attitudes and ratings of eleven basic colours on the elicited scales during the interview procedure of the experiment (see Section 4.10.1).

- Voice recorder equipment was utilised to record the session of each participant with his/her permission.

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[47] NCS-Munsell Translation Key is the property of Scandinavian Colour Institute AB, Stockholm. This translation key is the document in digital format (i.e. '.pdf') which consists of the lists of Munsell notations and corresponding translation lists of the nearest NCS notations.

[48] NCS Colour Scan 2.0 is a colour measurement tool which identifies the closest match to the NCS 1950 Original colour of the selected colour from any surface. It also gives the translations in LRV D65 2°/10°, CIE Lab D50 2°, CIE Lab D65 2°/10°, sRGB D65 2°, Adobe RGB D65 2°, CMYK Euro of the colours (Colour Scan, 2011).

[49] This generator service has been offered by random.org on the internet and has existed since 1998. The service, built by Mads Haahr, is operated from the School of Computer Science and Statistics at Trinity College, Dublin in Ireland (Random.org, 2011).

4.6 Colours as Stimuli

Hård (1969) claims that people perceive about eleven different colour categories, i.e. black, grey, white, yellow, orange, red, pink, purple, brown, blue and green, in order to simplify the verbal communication about colours out of thousands. These eleven colour categories are considered as universal basic colour terms or names by Berlin and Kay (1969) in accordance with the findings in their study on 98 languages, as well (see Section 2.4). As this research is based on searching for the individuals' attitudes towards perceived colours, it is believed that the attitudes of individuals towards colours can be defined and described by above mentioned eleven basic colour categories. For the reason that, these eleven colour categories subsume all possible colours that people perceive in their surroundings. Therefore, eleven colour categories, which are black, grey, white, yellow, orange, red, pink, purple, brown, blue and green, were used as stimuli for the experiment. These eleven colour categories hereinafter will be referred to as *eleven basic colours* throughout this research. The following sections discuss the selection and description of eleven basic colours, in detail.

4.6.1 Selection of Eleven Basic Colours

The experiment was carried out with Turkish participants living in Turkey; therefore, the representations of eleven basic colours are difficult to be in accord with the findings of the previous cross-cultural colour naming studies. Since people's perception of colours vary according to their memories, experiences, and educational, social and cultural backgrounds, asking which of each basic colour corresponds with its name mostly or precisely according to the perceiver is of great importance. For this reason, Şahin Ekici et al.'s (2006) research on 'Color Naming' which was conducted in six cities located in different regions of Turkey with the participation of Turkish people was utilised to select the colours for the experiment. The research was carried out as a part of PhD thesis in 1998 in Bilkent University Department of Interior Architecture and Environmental Design. In Şahin Ekici et al.'s (2006) study, 322 participants were asked to select the colour samples from Munsell Colour System (see Section 2.3.2) which corresponded mostly with eight basic (except black, grey and white colours) and 24 non-basic colour terms. Basic colours were needed to be employed in the course of the experiment, thus only the results of the eight basic colours from Şahin Ekici et al.'s (2006) study were taken into consideration. Table 4.3 shows the list of eight colours and corresponding notations in Munsell Colour System and the translations in Natural Colour System (NCS) (see Section 2.3.3 and see Section 4.6.2) for each colour that was salient as the result of most frequently selected colour terms among colour samples.

Table 4.3 The list of eight basic colour terms and corresponding notations of Munsell and Natural Colour System

EIGHT BASIC COLOURS	MUNSELL SYSTEM (Şahin et al.'s notations, 2006)	NCS SYSTEM (translated notations)
YELLOW	2.5 Y 8/16	S 0580-Y10R
	5 Y 8.5/14	S 0580-Y
ORANGE	10 R 6/14	S 0580-Y70R
	2.5 YR 6/14	S 1080-Y50R
	2.5 YR 6/16	S 0585-Y50R
	5 YR 7/14	S 0580-Y40R

Table 4.3 (cont'd).

RED	5 R 4/14	S 1080-R
	7.5 R 4/14	S 1580-Y90R
	7.5 R 4/16	S 1085-Y90R
	7.5 R 5/16	S 0580-Y90R
PINK	2.5 RP 8/6	S 0530-R30B
	2.5 RP 6/12	S 1050-R30B
	5 RP 8/6	S 0530-R20B
	5 RP 7/10	S 1040-R20B
	5 RP 6/12	S 1050-R20B
	7.5 RP 8/6	S 0530-R10B
	7.5 RP 5/14	S 1070-R20B
PURPLE	2.5 P 4/12	S 3050-R60B
	2.5 P 3/10	S 3555-R60B
	2.5 P 2/10	S 5040-R60B
	5 P 4/12	S 3050-R50B
	5 P 3/10	S 4050-R50B
BROWN	5 YR 4/6	S 5030-Y50R
	5 YR 4/8	S 4550-Y40R
	5 YR 3/4	S 7020-Y60R
	5 YR 3/6	S 6030- Y60R
	7.5 YR 4/8	S 5040-Y30R
	7.5 YR 3/4	S 7020-Y40R
	7.5 YR 3/6	S 7020-Y40R
BLUE	10 B 5/12	S 1565-B
	2.5 PB 5/12	S 1560-R90B
	5 PB 4/12	S 3060-R90B
GREEN	7.5 GY 6/12	S 1080-G30Y
	10 GY 5/12	S 2075-G20Y
	2.5 G 5/12	S 2070-G10Y

As the result of Şahin et al.'s (2006) research, the frequency of salient colours under eight basic colour terms exist with more than one colour and different in numbers. This means each basic colour term has the number of colours that corresponds to its name precisely.

For the experiment, eight colours were selected randomly from each set of colour terms (see Section 4.6) and three colours which are black, grey and white were selected from the achromatic scale of NCS Colour Atlas (see Section 2.3.3). The achromatic scale in NCS Colour Atlas consists of 19 colour samples and its apexes refer to white and black, and in between, grey colour samples in different values. Hence, the colour samples of two apexes; i.e. white and black, and the grey colour sample which is present in middle of white and black were selected. Consequently, eleven basic colours with their corresponding terms among colour samples were selected to be used for the experiment by the utilisation of Şahin Ekici et al.'s (2006) research on 'Color Naming' and the NCS Colour Atlas.

Table 4.4 summarises the definite list of eleven basic colours and corresponding NCS notations with their CIELAB specifications (see Section 4.6). The descriptions of the selected eleven basic colours are discussed in the following section.

Table 4.4 The specifications of eleven basic colours

ELEVEN BASIC COLOURS	NCS NOTATIONS	*L**	*a**	*b**
BLACK	S 9000-N	9.23	-0.22	-0.92
GREY	S 4500-N	50.03	0.10	0.40
WHITE	S 0300-N	94.37	-0.12	2.18
YELLOW	S 0580-Y	83.40	9.82	99.61
ORANGE	S 0585-Y50R	62.21	49.08	70.98
RED	S 1085-Y90R	41.62	59.05	39.20
PINK	S 0530-R30B	80.73	18.81	-5.21
PURPLE	S 3555-R60B	29.98	23.70	37.12
BROWN	S 6030-Y60R	29.71	21.11	23.72
BLUE	S 3060-R90B	40.43	-11.49	-38.80
GREEN	S 1080-G30Y	62.89	-34.96	65.81

*L** represents the vertical dimension and it correlates with perceived lightness. The two horizontal dimensions *a** and *b** represent the redness-greenness and yellowness-blueness in CIELAB colour space (see Section 2.3.1).

4.6.2 Description of Eleven Basic Colours

The NCS colour notation system is preferred to be used as the language of colour communication for this research. The system makes possible verbal descriptions of all surface colours as in the way people perceive them and as they appear in any situation. After determining the definite list of eleven basic colours, their original samples in size A6 (148 x 105 mm) were ordered from NCS Colour AB (Scandinavian Colour Institute AB) to be used for the experiment. The colour samples were mounted on cards of the same dimensions to be viewed in the viewing cabinet. Figure 4.3 shows the colour samples of the defined eleven basic colours.

Figure 4.3 Eleven basic colour samples used for the experiment

The NCS is a system for ordering of colours which depends on six elementary colours, i.e. two achromatic colours: pure white (W) and pure black (S); four chromatic colours: pure yellow (Y), pure red (R), pure blue (B), and pure green (G). The system orders colours according to their perceptual elementary attributes which are quantified as whiteness, blackness, yellowness, redness, blueness, and greenness. All colours can be described by their degree of visual resemblances either to six elementary colours or to perceptual elementary attributes. The visual resemblance to these six elementary colours of a colour is projected on the NCS colour circle and its resemblance to elementary attributes is displayed on the NCS colour triangle (see Section 2.3.3). In accordance, Figure 4.4 shows the NCS notations of eleven basic colours and their locations in the NCS colour circle and triangle according to their colour areas.

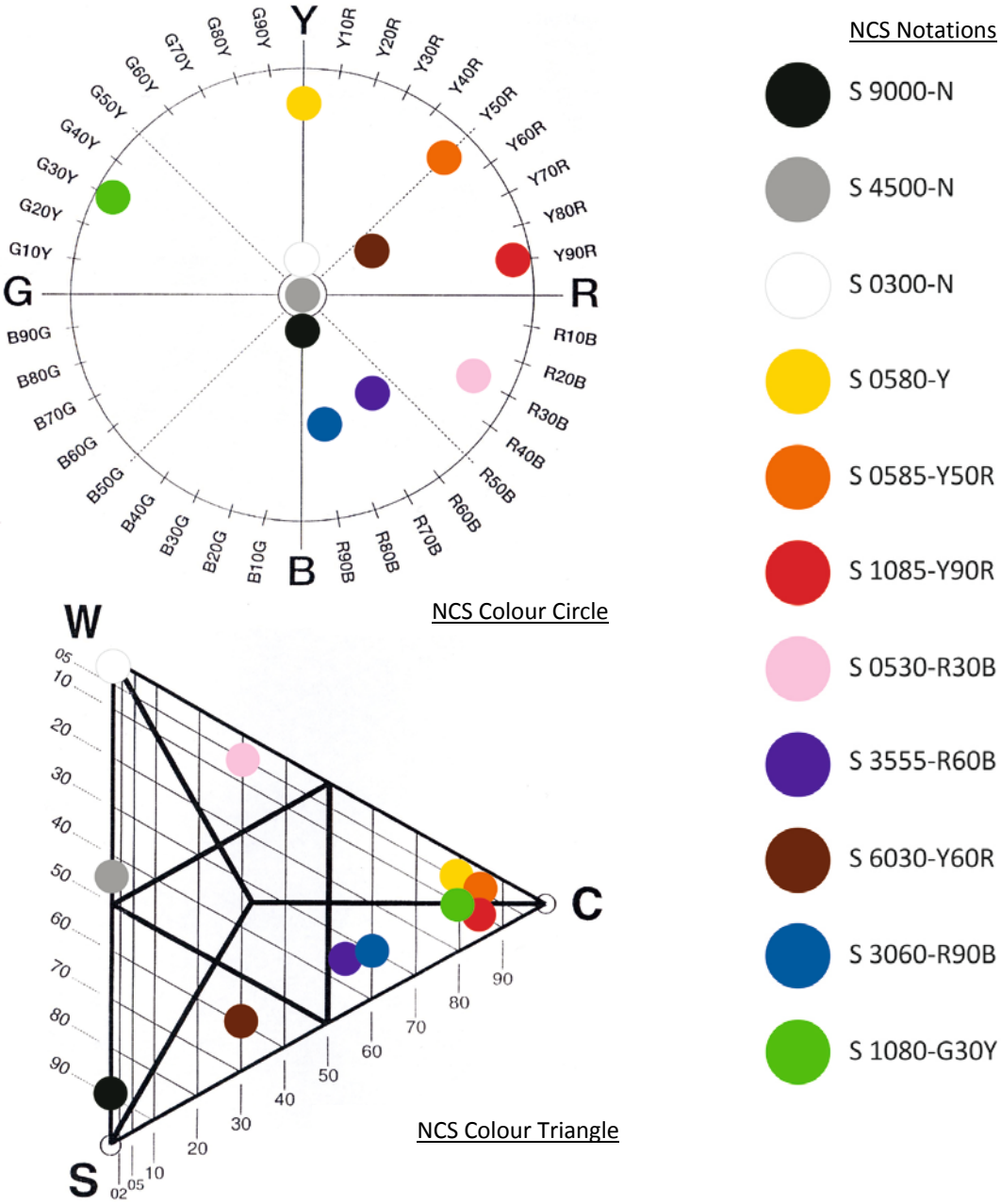


Figure 4.4 The NCS notations of eleven basic colours and their locations in the NCS colour circle and triangle

Eleven basic colours with their corresponding terms among the NCS notations are presented in Figure 4.4. The perceptual qualities of each colour are denoted by two parts in the NCS system. In other words, the notation system of the NCS is designated by two parts, i.e. the NCS nuance, and the NCS hue. The NCS nuance is defined as the relative resemblance of colours to the elementary colours W, S, and the pure chromatic colour C and specified by a notation in the NCS colour triangle. The NCS hue, on the other hand, is defined as the percentage of the resemblance between the two elementary colours and specified by a notation in the NCS colour circle (see Figure 4.4). Table 4.5 describes the resemblances of each eleven basic colour to the NCS nuance and NCS hue with its corresponding term.

Table 4.5 The descriptions of the resemblances of eleven basic colour notations to the NCS nuance and NCS hue in the NCS system

ELEVEN BASIC COLOURS	**NCS NOTATION**	
	NCS Nuance	**NCS Hue**
BLACK	**S 9000** 90% resemblance to blackness and no resemblance to chromaticness	**-N** Neutral
GREY	**S 4500** 45% resemblance to blackness and no resemblance to chromaticness	**-N** Neutral
WHITE	**S 0300** 3% resemblance to blackness and no resemblance to chromaticness	**-N** Neutral
YELLOW	**S 0580** 5% resemblance to blackness and 80% resemblance to chromaticness	**-Y** 100% resemblance to yellow
ORANGE	**S 0585** 5% resemblance to blackness and 85% resemblance to chromaticness	**-Y50R** 50% resemblance to yellow and 50% resemblance to red
RED	**S 1085** 10% resemblance to blackness and 85% resemblance to chromaticness	**-Y90R** 10% resemblance to yellow and 90% resemblance to red
PINK	**S 0530** 5% resemblance to blackness and 30% resemblance to chromaticness	**-R30B** 70% resemblance to red and 30% resemblance to blue
PURPLE	**S 3555** 35% resemblance to blackness and 55% resemblance to chromaticness	**-R60B** 40% resemblance to red and 60% resemblance to blue

Table 4.5 (cont'd).

BROWN	**S 6030** 60% resemblance to blackness and 30% resemblance to chromaticness	**-Y60R** 40% resemblance to yellow and 60% resemblance to red
BLUE	**S 3060** 30% resemblance to blackness and 60% resemblance to chromaticness	**-R90B** 10% resemblance to red and 90% resemblance to blue
GREEN	**S 1080** 10% resemblance to blackness and 80% resemblance to chromaticness	**-G30Y** 70% resemblance to green and 30% resemblance to yellow

Figure 4.4 displays the locations of the NCS notations of eleven basic colours in the NCS circle and triangle. Table 4.5, on the other hand, describes the resemblances of the NCS notations of eleven basic colours to the NCS nuance and NCS hue in the NCS circle and triangle. Showing the locations and describing the resemblances of the notations in the NCS circle and triangle are based on the colour areas of eleven basic colours in the NCS system. However, eleven basic colours can be described verbally according to their nuance areas in the NCS system by specifying their main attributes[50] in the NCS triangle. This leads to obtain the verbal descriptions of eleven basic colours as they are perceived besides defining them only with their corresponding terms. Three achromatic colours which are black, grey, and white are considered as neutrals, hence Table 4.6 displays the verbal descriptions of eight basic colours according to their nuance areas in the NCS system with their main attributes in the NCS triangle.

Table 4.6 The verbal description of eight basic colours with their main nuance attributes

ELEVEN BASIC COLOURS	MAIN ATTRIBUTE	VERBAL DESCRIPTION
YELLOW	Chromaticness	Brilliant
ORANGE	Chromaticness	Brilliant
RED	Chromaticness	Brilliant/Deep Chromatic
PINK	Whiteness	Light Clear
PURPLE	Chromaticness	Deep Chromatic
BROWN	Blackness	Dark Deep
BLUE	Chromaticness	Deep Chromatic
GREEN	Chromaticness	Brilliant/Deep Chromatic

[50] Colours differ with regard to nuance attributes such as chromaticness, whiteness, and blackness. Although a colour embodies the entire nuance attributes (except neutrals), it should have much more resemblance to one of these attributes (called main attribute: such as chromaticness) and least resemblance to other two attributes (called secondary attribute: such as whiteness and blackness).

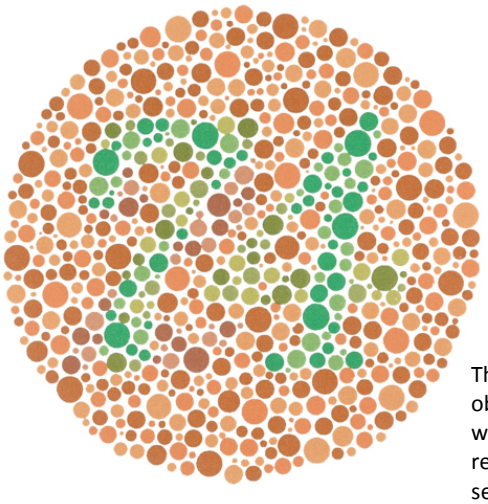
4.7 Ishihara Test for Colour Blindness

People's perception of colour depends on two classes of receptors in the retina, rods and cones, named according to their shape. Rods are extremely sensitive to light and detect very small amount of it like starlight. Rods enable people to see in very dim conditions which allow the brain to see objects as black or white or shades of grey. Rods cannot differentiate colours; however the cones are the colour receptors which have lower sensitivity to incident light but have more sensitivity to colours. People's sensations of colour are the result of having three types of cones. These cones respond differently to the light of various wavelengths, i.e. long (L), middle (M), short (S) and allow the brain to see the colour of objects and surfaces (Zollinger, 1999; Berns, 2000; Feisner, 2001).

The physical shapes of the receptors especially the chemical compounds of the colour receptors vary among the population and within the retina. This means not only the amount of macular[51] pigment varies from person to person also each person has different lens absorption and scattering properties. About 8% of the male and 0.5% of the female population have colour-defective vision which has three types. Either one or more receptor type is missing, it is known as *dichromats*; or one of the cones has spectral sensitivity that is changed in wavelength, it is known as *anomalous trichromats*. *Achromatopsia* is known as the third type of colour vision deficiency which is defined as the inability to see colour (Berns, 2000).

In order to test people's colour vision deficiencies, the most common screening test was developed by Shinobu Ishihara in 1917 for red-green colour deficiencies. The test contains a number of pseudo-isochromatic plates, called Ishihara colour test plates, each of which contains random dots in different colour and size embedded with numbers. The full test consists of 38 plates however the existence of a deficiency can be determined clearly after a few plates (Berns, 2000).

As the main emphasis of this research is based on eliciting individuals' idiosyncratic attitudes towards perceived colours, colour blindness test needed to be applied to the participants in order to prevent the bias that will occur. Otherwise, this will result to elicit unreliable data from the participants because of perceiving the colours differently. The purpose of screening the Ishihara colour blindness test did not diagnose the type of colour vision deficiency of the participants; it was to ensure the participants who attended to the experiment had normal colour vision. Figure 4.5 displays one of the Ishihara colour test plates that were shown to the participants before the data collection procedure in the experiment.



The numeral '74' should be clearly visible to the observers with normal colour vision. Observers with dichromat or anomatous trichromat may read it as '21', and observers with achromat may see nothing.

Figure 4.5 An example of the Ishihara colour test plate used in the experiment

[51] Oxford dictionary defines *macula* as "an oval yellowish area surrounding the fovea near the centre of the retina in the eye, which is the region of keenest vision." (Oxford Dictionaries, 2012, n.p.).

A total of ten Ishihara colour test plates were displayed on the notebook screen before the data collection procedure of the experiment to test whether the participants have colour vision deficiencies. In the case of a participant not being able to see any of the colour test plates on the screen, then it was planned to show the hard copy of the test plates inside the viewing cabinet. If the participant was still unable to read any of the Ishihara colour test plates, he/she would not be referred as a participant for the experiment.

4.8 Participants

The experiment was conducted on voluntary participation. Undergraduate students of METU Faculty of Architecture were decided as the subject group for the experiment. The purpose was to create a homogeneous subject group without expectations of participants being in the same years or having any background knowledge about colour. The undergraduate students from two different departments, Industrial Design and Architecture, thus, were asked and requested for their participation for the experiment one by one. A schedule was planned according to the timetable of the students who indicated their participation to the experiment.

A total of 88 undergraduate students volunteered for the study. 25 of them either did not attend the experiment in time that they specified or cancelled their participation. Colour vision deficiencies were found in three of the undergraduate students who attended the experiment according to the Ishihara test for colour blindness that was presented before the procedure. Therefore, these three students were not used as participants for the experiment. The experiment was consequently carried out with the participation of 60 undergraduate students, 35 from Department of Industrial Design (ID) and 25 from Department of Architecture (Arch.). Thirty of the participants were male and 30 were female. In order to examine the gender differences of the elicited idiosyncratic attitudes towards perceived colours, genders of the participants were kept as equal. Their ages varied from 20 to 27, the mean age of the total population was 22. Table 4.7 shows the frequency distributions of the subject group according to gender, department, and age (see Appendix B for the demographic features of each participant).

Table 4.7 The frequency distributions of the subject group of the experiment

	Number of Participants			**Department**		**Age**		
METU Faculty of Architecture	**Male**	**Female**	**Total**	**ID**	**Arch**	**Min.**	**Max.**	**Mean**
	30	30	60	35	25	20	27	22.35

4.9 Data Collection with Repertory Grid Technique

The repertory grid technique (RGT) was developed as an application of the theory of Personal Constructs by George Kelly in 1955. The RGT is a procedure for the elicitation of personal constructs and the exploration of their structure and interrelations. It is considered as a structured interview technique that aims at exploring the ways in which individuals construct the world around them (or stimuli). The technique is based on asking questions regarding the similarities and/or differences between stimuli (or called elements). The individuals' statements that define the reasons of the stimuli being alike or different are their personal constructs. A construct hence is defined as individuals' way of distinguishing similarity from difference. In other words, a construct is a bipolar similarity-difference judgement (see Section 2.6). In the scope of this research, the elicited personal constructs of individuals are considered as *attitudes of individuals* and the stimuli used for the

procedure in order to distinguish the similarities or differences between them are *eleven basic colours*.

The most popular and common construct elicitation technique is employed by the RGT is called *triading* (see Section 2.6.1). Although there are a variety of procedures for the elicitation of personal constructs, eliciting constructs from triads is considered as a classical approach. This method involves selecting three elements (triad) from a pool of elements and presenting them at a time, and individuals are then asked to identify "[…] in what way two of these elements are alike and in what way the third element is different from the other two." (Easterby-Smith, 1980, p. 6). Another method for the elicitation of personal constructs is called *dyading* (see Section 2.6.1). In that case, the procedure involves selecting two elements (dyad) at a time and individuals are asked to identify "[…] whether they [two elements] are alike or different, and what it is that makes them alike or different." (Easterby-Smith, 1980, p. 7). Both procedures intend to produce two contrasting poles, which should be opposites in meaning rather than logical opposites, for the construct. The interviews of both procedures continue with presenting successive triads or dyads at a time until the individual is unable to produce a novel construct. The result of both methods is a list of personal constructs that the individual uses to distinguish between a set of elements.

Once the constructs are obtained depending on which of the method, either using triads of elements or using dyads of elements, is used for the elicitation of idiosyncratic views of individuals, the elicited constructs are employed with rating method (see Section 2.6.1). Each participant rates the set of elements on his or her own elicited constructs. Since the constructs are qualitatively elicited with the structured interviewing technique that is employed in the RGT, the ratings of elements then quantify the qualitative insight of the constructs. The RGT is consequently employed with two steps of methods, structured interview and rating method. For this reason, the RGT is considered as both qualitative and quantitative.

Although the most common procedure for generating constructs is to elicit them from triads, it is also possible to elicit constructs from dyads as has been already stated above. The dyadic procedure is used when the elements themselves are complex or when the individuals find it too hard to generate constructs from triads. In the case of this research, eleven basic colours are planned to be used as elements for generating personal attitudes of individuals. These colours are presented as colour samples without any reference to an object or a product. Although in samples, colours are abstract and therefore complex to talk about verbally, it was thought that individuals may find it difficult to distinguish similarities in and differences between these eleven basic colours. Since the RGT is adapted for the first time for distinguishing the similarity and differences of colours, it is important to determine which of the methods of triadic and dyadic data collection procedures for eliciting idiosyncratic attitudes of individuals is more appropriate for the research. The pilot study thus was conducted for this purpose to find out the efficient and effective way of generating bipolar idiosyncratic attitudes of individuals from eleven basic colours.

4.9.1 Pilot Study for Testing Data Collection Methods

A pilot study was conducted to try out the research approach in order to identify the potential problems that might affect the quality and the validity of the main study. The emphasis of the pilot study was mainly on the examination of the method and the procedure that is employed in the RGT. The findings thus were expected to set a guide for the improvement of the experiment.

The main objective of the pilot study was to examine the differences between the methods of triadic and dyadic data collection procedures for eliciting personal attitudes of individuals. On the other hand, developing a suitable scaling format for recording the elicited idiosyncratic attitudes of individuals through the course of the procedure and finding a suitable way of rating method to link each participant's own elicited attitudes to the perceived colours were of great importance to

investigate during the pilot study, as well. These three objectives, where the last two subordinated the main objective, needed to investigate before conducting the experiment.

The pilot study was considered as a preliminary trial of the experiment. Therefore, the experimental set-up (see Section 4.5) of the experiment, the tools and equipment (see Section 4.6) and eleven basic colours as stimuli (see Section 4.7) that were utilised for the experiment were provided as same in the pilot study. As the emphasis of the pilot study was on trying out the differences between the triadic and dyadic data collection methods and the related procedures for the elicitation of idiosyncratic attitudes of individuals, it was ceased when the necessary feedback and data were obtained to distinguish the differences between two procedures. Subsequently, the pilot study took place with a limited number of six subjects who voluntarily participated in the study. They were all graduate students of METU Department of Industrial Design. Their ages varied from 23 to 29, the mean age of the whole group was 27. Three of these participants were male and three were female (see Table 4.8). It was planned to request undergraduate students of METU Faculty of Architecture to be participant in the experiment (see Section 4.9); therefore graduate students were asked participation for the pilot study in order not to use same participants for both studies.

4.9.1.1 Procedure

In order to ensure the differences between the triadic and dyadic data collection methods for eliciting idiosyncratic attitudes of participants towards eleven basic colours, the procedure of the pilot study was divided with the equal number of participants into two phases, namely a) triads of colours and b) dyads of colours. Although two methods had differences in practice, which are discussed in detail in the following sections, the common steps were carried out through the course of both procedures, which are described in the following.

Each participant was led into the experiment room individually and was seated at a desk, where the viewing cabinet was situated (see Section 4.5). The participant was given ten Ishihara colour test plates to test whether he/she had a normal colour vision (see Section 4.8). All six participants passed the colour test plates of Ishihara. Each participant then was given a brief explanation on what was expected from the session and a quick attribute elicitation example was demonstrated by the researcher. Afterwards, the participant was left free for a few minutes to familiarise him/herself with the presented eleven basic colours and also the lighting conditions in the experiment room.

Before the procedures of the pilot study, two types of pre-formatted grid data sheets, so-called 1st and 2nd type of grid format (see Appendix C), were prepared. Each participant was requested to select one of the grid formats which was more appropriate and understandable for him/her for the purpose of scaling the bipolar elicited idiosyncratic attitudes of him/her and rating eleven basic colours on his or her own elicited attitudes.

The above mentioned common steps were performed before practicing the triadic and dyadic data collection methods for eliciting idiosyncratic attitudes of participants towards eleven basic colours. The triadic and dyadic data collection methods carried out with the participation of three subjects for each procedure are discussed in the following sections.

4.9.1.1.1 Triads of Colours

The triadic data collection method of the pilot study was based on eliciting idiosyncratic attitudes of participants from the sets of triads. 40 sets of triads were employed by utilising the random sequence generator before the procedure (see Section 4.6). The first set of triad of colours was placed in the viewing cabinet and the participant was asked to specify which of the two colours were alike and which of the third colour was different from the other two. After the participant specified the alikeness and the differentness of the colours in triad, he/she was asked to define verbally, in

what attribute the two colours were similar and in what attribute the third differed from the other two. The procedure of RGT itself intends to produce two contrasting poles for a construct/attitude. By this way, only the emergent pole of the construct was elicited, therefore the participant was requested to produce its contrast or opposite. In this sense, the implicit pole was expected to be produced by defining the emergent pole's opposite in meaning rather than by delivering the word's antonym. Hence, one personal construct with its two poles were achieved.

This attitude elicitation procedure was continued until the participant was unable to identify an additional construct for the combination of the first set of triad. Besides, the participant was free to change the combination of the alikeness and differentness of the same set of colours. After collecting the personal attitudes from the first triad, the second set of triad was placed in the viewing cabinet and this procedure continued with the successive triads. It is important to note that the sets of triads were presented disorderly to prevent repetition of one or two colours in successive triads, because this could raise a level of difficulty for the participants in thinking of novel constructs.

Throughout the triadic procedure the researcher noted down the elicited attitudes of the participant on the pre-formatted data sheet that he/she selected before the procedure. At the end of the procedure, all eleven basic colour samples were placed in the viewing cabinet. Then, the participant was asked to rate each basic colour in turn on a 7-point rating scale by his or her own elicited polar attitudes, from '1' for the implicit (left) pole through '7' for the emergent (right) pole. The duration of each session of the procedure of triadic data collection differed from 32 to 40 minutes (see Table 4.8) and the same procedure was followed in all sessions.

4.9.1.1.2 Dyads of Colours

The dyadic data collection method of the pilot study was based on eliciting idiosyncratic attitudes of participants from the sets of dyads. 40 sets of dyads were determined by performing the random sequence generator before the procedure (see Section 4.6). Later, the first set of dyad of colours was presented in the viewing cabinet and the participant was asked to specify whether the two colours were alike or different; and what sort of attributes made these two colours alike or different. By this way the emergent pole of one construct/attitude was elicited and the participant was requested to define the implicit pole by producing the emergent pole's opposite in meaning.

This attitude elicitation procedure was continued until the participant was unable to identify an additional construct for the first set of dyad. Besides, the participant was free to change the alikeness and differentness of the same set of colours. After collecting the personal constructs from the first dyad, the second set of dyad was placed in the viewing cabinet and this procedure was continued with the successive dyads. Again, it is important to note that the sets of dyads were presented disorderly to prevent repetition of a colour in successive dyads, as this could raise a level of difficulty for the participants in thinking of novel constructs.

Throughout the dyadic procedure the researcher recorded the elicited attitudes of the participant on the pre-formatted data sheet that he/she selected before the procedure. At the end of the procedure, all eleven basic colour samples were placed in the viewing cabinet. Then, the participant was asked to rate each basic colour in turn on a 7-point rating scale by his or her own elicited polar attitudes, from '1' for the implicit (left) pole through '7' for the emergent (right) pole. The duration of each session of the procedure of dyadic data collection differed from 25 to 38 minutes (see Table 4.8) and the same procedure was followed in all sessions.

4.9.1.2 Data Analysis

The basis of the data analysis was composed of each participant's personal attitude list that the participants used to distinguish between eleven basic colours. The technique of content analysis for

the first step and descriptive analysis for the second step was used to analyse the elicited data that was gathered from two procedures.

For the first step, content analysis was used to examine the contents of the elicited data of the triadic and dyadic method. All elicited personal attitudes that were collected during both procedures were reviewed by the researcher. In the process of reviewing, different attitudes with same meaning were rephrased to a single new form of an attitude. All attitudes were translated into English as the study was carried out in the participants' native language, i.e. Turkish.

For the second step, descriptive analysis was used to do a systematic description of the elicited data by calculating the frequencies and averages of them. Each participant's elicited bipolar attitude scales were tabulated separately. This data also included the participant level ratings of each eleven basic colour. In the process of descriptive analysis, the frequencies of the sets of triads and dyads of colours that were utilised during both procedures and the averages of the elicited attitudes of each participant were analysed. In addition, the interpersonal analysis of the elicited attitudes of three participants from the triadic data and three participants from the dyadic data were examined, as well. The results of both methods are discussed in the following section.

4.9.1.3 Results

The results of the procedures depend not only on the requested feedback of the participants and the observations done by the researcher during the course of the two procedures, but also upon the data analysis of each participant. The results of the applied methods of the pilot study comprised of only the results of the content analysis and descriptive analysis of the data because of not having numerous numbers of participants to do statistical generalisation. The following parts discuss the results in case of the method of triad and the method of dyad, and common results for both methods.

Results of Triadic Data Collection Method

A total of 13 sets of triads of colours were utilised for the procedure of triadic method, ranging from four to five sets of each session. In accordance with these triads, the average number of the attitudes that were elicited from three participants was 10.3, ranging from seven to twelve attitudes (see Table 4.8).

During the procedure, participants were requested to specify the alikeness and differences of the colours in the sets of triads that was presented and to elicit their attitudes accordingly. Only one participant elicited his attitudes by changing the composition of the alikeness and differences of the colours in one set of triad twice across five sets of triads that were presented in his session.

From the full set of triadic data, 27 personal attitudes were elicited in total. Three attitudes were mentioned by two participants each, which are: *characterful-characterless*, *cheerful-sad*, and *warm-cool*. The rest of 24 elicited personal attitudes were mentioned by only one participant each (see Table 4.9).

Results of Dyadic Data Collection Procedure

A total of 13 sets of dyads of colours were utilised for the procedure of dyadic method, ranging from four to five sets of each session. In accordance with these dyads, the average number of the attitudes that were elicited from three participants was 9.6, ranging from 9 to 10 attitudes (see Table 4.8).

During the procedure, participants were requested to specify the alikeness and differences of the colours in the sets of dyads that was presented and to elicit their attitudes accordingly. Only one participant elicited her personal attitudes by specifying one set of dyad of colours as both alike and different across four sets of dyads that were presented in her session.

From the full set of dyadic data, 22 personal attitudes were elicited in total. The attitude *natural-artificial* was mentioned by all three participants. Four attitudes were mentioned by two participants, which are: *dominant-recessive*, *dynamic-static*, *harmonious-disharmonious*, and *bright-dim*. The rest of 17 personal attitudes were mentioned by only one participant each (see Table 4.9).

Common Results for Both Methods

There are some common results observed in both methods. Five out of six participants selected the 2nd type of grid format (see Appendix C.2) and the participants identified that it was more appropriate and understandable for the purpose of the scaling and rating method. Additionally, two participants stated that it was hard to rate eleven colours at the end of the session because they had difficulty in assigning the attributes of colours of the contrasting poles of the attitudes. Lastly, all six participants criticised that the grey colour sample was lost in the background colour of the viewing cabinet.

Table 4.8 shows the frequency distributions of three participants that was used for each data collection method according to age, gender, the number of triads and dyads of colours that were utilised and the number of elicited idiosyncratic attitudes of each participant and lastly, the duration of each session.

Table 4.8 The frequency distributions of the participants in both methods in the pilot study

Triadic Data Collection Method					
Participant	Age	Gender	Number of Triads	Number of elicited attitudes	Duration
P01	23	Male	4	12	40'
P02	29	Female	4	7	27'
P03	28	Male	5	12	32'
Dyadic Data Collection Method					
Participant	Age	Gender	Number of Dyads	Number of elicited attitudes	Duration
P01	27	Male	4	10	38'
P02	29	Female	4	9	25'
P03	27	Female	5	10	30'

Table 4.9 displays the list of all elicited attitudes of the participants. The marks in the table show how many times an attitude has been mentioned by one or more than one participant (interpersonal repetitions of an attitude) in the triadic and dyadic data collection methods.

Table 4.9 The list of all elicited attitudes from the triadic and dyadic data collection methods

List of Elicited Attitudes							
Triadic Data				**Dyadic Data**			
Bipolar Attitudes	**P01**	**P02**	**P03**	**Bipolar Attitudes**	**P01**	**P02**	**P03**
active-passive			X	active-passive	X		
aggressive-calm	X			alive-inanimate	X		
alive-inanimate	X			attractive-unattractive	X		
appetising-unappetising	X			bright-dim		**X**	**X**
attractive-unattractive		X		cheering-gloomy		X	
characterful-characterless	**X**		**X**	clean-dirty	X		
charming-charmless		X		conspicuous-inconspicuous			X
cheerful-sad	**X**	**X**		dominant-recessive	**X**	**X**	
clean-dirty	X			dynamic-static	**X**	**X**	
compatible-incompatible			X	energetic-dull			X
conspicuous-inconspicuous	**X**		**X**	fast-slow			X
dominant-recessive			X	harmonious-disharmonious	**X**	**X**	
elegant-inelegant		X		heavy-light		**X**	**X**
energetic-dull	X			innocent-malicious	X		
entertaining-boring			X	light-dark		X	
expressive-unexpressive		X		luminous-dark			X
extraordinary-ordinary			X	masculine-feminine	X		
familiar-unfamiliar			X	modern-traditional			X
fashionable-old fashioned			X	natural-artificial	**X**	**X**	**X**
light-dark			X	opaque-transparent		X	
luminous-dark	X			remarkable-dull			X
mature-immature	X			transitional-discrete			X
natural-artificial			X				
optimistic-pessimistic		X					
refreshing-suffocating	X						
remarkable-dull	X						
warm-cool		**X**	**X**				

4.9.2 Discussions on Data Collection Methods of the Pilot Study

The pilot study dealt with the two procedures of attitude elicitations, which have been widely used as structured methods for the elicitation of personal constructs by utilising the methods of triads of colours and dyads of colours. The findings of the pilot study were considered as a guide for the improvement of the procedure and method of the RGT in terms of colour attitude scale elicitations of the experiment. The data collection procedure of the pilot study was divided with the equal number of participants into two phases as triads of colours and dyads of colours. The findings

depended mostly on the observations done by the researcher during the course of the two procedures. The data analysis of each participant's personal attitude list and the feedback of the participants' experiences during construing eleven basic colours were taken into consideration, as well.

For the elicitation of personal attitudes towards eleven basic colours in the main study of this thesis, the dyadic data collection method is considered to be much more applicable than the method of triadic data collection although the elicited opposite poles of the attitudes and their related ratings in both methods were valid to do content and statistical analysis. In the following, the reasons behind the preferred procedure are described by comparing the findings of two methods.

1. In sets of different triads, eleven basic colours have 165 probabilities to appear whereas they have 55 probabilities to occur in sets of different dyads. All eleven basic colours thus have much more possibility to be presented in dyads than in triads.

2. During the dyadic data collection procedure, it was observed that participants generally yielded a pair of opposites without requesting the implicit pole of the emergent pole of the attitude. It was also observed that each pole of the elicited construct in dyadic procedure related to a colour of the presented dyad. However, in the triadic data collection method, after eliciting each emergent pole from the participants, it was asked to elicit its implicit pole. This led participants to show more effort to state their opposites.

3. It was observed that more explicit contrast poles were elicited using dyads of colours because the comparison of two colours generally yielded to produce clear opposites. The participants in dyadic method generally construed colours by defining them with one adjective for each pole. On the other hand, more than one adjective for each pole of the attitude was obtained using triads of colours because the participants needed to support what they meant by stating that attitude. Obtaining more than one adjective for the same attitude pole brought difficulty in doing content analysis for the elicited data of the triadic method and in finding a suitable adjective either in Turkish or in English. This also brought difficulty for the researcher while doing content analysis of the data in order not to lose the underlying meanings of the elicited attitudes of the participants.

4. In accordance with the observations during both procedures, the dyadic data collection method seemed to be much more reliable than the triadic method. The reason is that, two colours grouped as alike in a triad would produce a divergence of the third colour. The differences between the two similar colours thus were ignored, since they were not given the chance to be specified as different. On the other hand, each colour had its own characteristics in dyadic method hence it gave the opportunity to each colour to be construed separately.

5. Although the sample group of the pilot study was composed of three participants for each method, the elicited data of the dyadic method showed that (see Table 4.9) the elicited idiosyncratic attitudes of the participants were much more interpersonal according to the frequency of mention of each attitude for each participant. Using dyadic data collection method thus enables to gather more interpersonal data to be able to generalise on the basis of the findings in this research of area.

Besides the comparison of the findings of two procedures, it is realised that the participants find it hard to construe colours, to talk about them verbally and to generate their attitudes to distinguish between the similarities and differences of eleven basic colours. Consequently, it is preferred to apply dyadic data collection method for the RGT in terms of construing eleven basic colours for the main study of this thesis in order to prevent the complexity and overloading of the procedure.

According to the findings of the pilot study, the experiment will be conducted considering the following features during the elicitation process of colour attitude scales.

1. The 2nd type of grid format (see Appendix C.2) is used for recording the elicited attitudes from the participants. This grid format, in which the implicit (left) and emergent (right) poles of the elicited attitudes are placed at each end of the rating scale, is similar to the semantic differential scale devised by Osgood et al. (1957). Besides the statistical analysis that is offered by the RGT, this grid format also gives the opportunity to apply the statistical analysis that is offered by the semantic differential for the main research.

2. The method of RGT consists of several stages and leads to deep interviews, therefore getting bored during the procedure or forgetting the assigned attributes of the contrasting poles of the attitudes are to be expected. Thus, in order to provide the validity and reliability of the main study, it is decided to request from the participants to rate colours after the attitudes are elicited for each dyad, before moving on to the next set of dyad, rather than at the end of the procedure.

3. Lastly, in order to the make the grey sample more visible while presenting it with another colour in the viewing cabinet, it is considered to use a white colour background in the experiment.

4.9.3 Grid Format used for Data Collection in the Experiment

The RGT requires a grid format for enrolling the collected data. The 2nd type of grid format (see Appendix C.2) was found more appropriate and understandable for the purpose of the scaling and rating method by the majority of the sample group in the pilot study (see Section 4.10.2). For the experiment, the grid format was improved according to the findings of the pilot study for setting down the elicited personal attitudes during the interviews of each participant and recording the ratings of eleven basic colours on each participant's own elicited attitudes. Therefore, the preferred type of grid was decided to be utilised for the experiment by referring to it as *the grid format*.

Before the dyadic elicitation procedure of the RGT, the grid format was pre-prepared in blank for the purpose of using it separately for each participant in his/her interview process. Through the course of the interview of each participant, this blank gird was manually filled by the researcher according to the elicited personal attitudes of him/her and ratings of eleven basic colours on his/her own attitudes. The experiment was carried out in the participants' native language, i.e. Turkish, therefore the grid format was prepared in Turkish.

Figure 4.6 shows the blank grid format that was used for the data collection procedure of the experiment. This grid format consisted of five parts; each part is discussed in detail by exemplifying one of the grids of the participants. The original grid of the participant number 29 (hereinafter P29) is used as an example to describe the content and parts of the grid format. The parts of it, namely topic and documentation, information on rating method, set of colours, left pole and right pole, and ratings, are discussed in the following subsections in detail.

11 Temel Rengin Ayırt Edici Özellikleri **Tarih:**

Katılımcı No: **Yaşı:** **Cinsiyeti:** ☐ K ☐ E **Bölümü:** **Görüşme Süresi:**

Lütfen aşağıda isimleri yer alan 11 rengi (R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11), sizin tarafınızdan tanımlanan karşıt özelliklerini birbirinden bağımsız olarak ne kadar taşıdığına dair **1'den 7'ye** (düşükten yükseğe) kadar değerlendiriniz.

1 2 3 4 5 6 7

[IP] TUTUM SOL	SİYAH **R1**	GRİ **R2**	BEYAZ **R3**	SARI **R4**	TURUNCU **R5**	KIRMIZI **R6**	PEMBE **R7**	MOR **R8**	KAHVERENGİ **R9**	MAVİ **R10**	YEŞİL **R11**	**[EP] TUTUM SAĞ**

Figure 4.6 The blank grid format used for each participant in the experiment (in Turkish)

4.9.3.1 Topic and Documentation

This part of the grid format includes the topic of the grid, date of the interview; the participant's number, age, gender, department and interview time. Figure 4.7 shows the documentation part of the grid of P29 with her recorded demographic features.

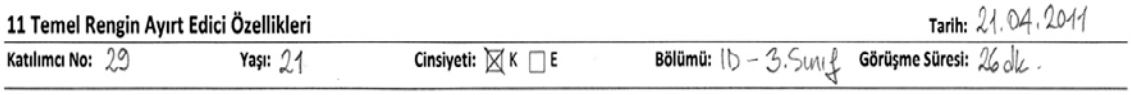


Figure 4.7 The documentation part of the grid of P29 (in Turkish)

The topic shows what the grid was about. As the research was based on eliciting the participants' ways of distinguishing similarity and/or differences between eleven basic colours in their own words, it was titled as '*The Distinguishing Features of 11 Basic Colours (11 Temek Rengin Ayırt Edici Özellikleri)'* by the researcher. Besides the topic of the grid, the same row includes for a place for filling the '*date (tarih)'* of the interview of the participant.

The row below the topic and date was allocated for recording the demographic features of the participant. The participants' names were not preferred to be enrolled onto their grids to keep their names confidential; instead, according to the participants' sequences of attending their interviews, they were coded with numbers. After specifying the '*participant's number (katılımcı no.)'* on his/her grid, the participant's '*age (yaşı)'*, '*gender (cinsiyeti)'*, '*department (bölümü)'* was enrolled before the interview and his/her '*interview time (görüşme süresi)'* were recorded at the end of the procedure on the same grid, as well. In Figure 4.7, the participant's number, age, gender and department were recorded as 29, 21, female and Industrial Design 3rd year, respectively. Her interview time was noted down as 26 minutes at the end of the procedure. The purpose of this part was only to make a documentation of the above mentioned features of each participant.

4.9.3.2 Information on Rating Method

The information part of the grid format consisted of the information about the rating method of the RGT, although each participant was given a brief explanation upon what was expected from the session verbally (see Section 4.10.4). As a rating method in the experiment, a rating scale method was utilised. Although various rating scales have been used in the RGT depending on the purposes of the research (see Section 3.2), a seven-point rating response scale was preferred in the case of this research. The information part of the grid format, therefore, requested each participant to rate each basic colour on his/her own elicited attitudes as follows (see Figure 4.8).

Please rate 11 colours (C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C11) independently from 1 to 7 (low to high) according to the contrasting properties that are defined by you below (Lütfen aşağıda isimleri yeralan 11 rengi (R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11), sizin tarafınızdan tanımlanan karşıt özelliklerini birbirinden bağımsız olarak ne kadar taşığıdığına dair 1'den 7'ye (düşükten yükseğe) kadar değerlendiriniz).

Lütfen aşağıda isimleri yer alan 11 rengi (R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11), sizin tarafınızdan tanımlanan karşıt özelliklerini birbirinden bağımsız olarak ne kadar taşıdığına dair **1'den 7'ye** (düşükten yükseğe) kadar değerlendiriniz.

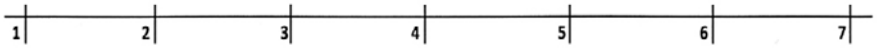


Figure 4.8 The information part on the rating method of the grid format (in Turkish)

It was believed that asking the participants to rate eleven basic colours on a 7-point scale led them to make finer discriminations and judgements on their elicited personal attitudes among each basic colour. Since the scale was short, the participants had less choice for ratings. In order to visualise the 7-point scale, a scale ruler was placed below the required statement in the grid format. It was thought that this ruler could help the participants as they were defining how each basic colour was related to their elicited polar poles of the attitudes. The numbers 1, 2, 3, 4, 5, 6, and 7 on the scale shows which end of the scale the elicited polar attitudes are nearest to (see Figure 4.8). The elicited attitudes on the left hand pole stand for the '1' end of the scale and the elicited attitudes on the right hand pole stand for the '7' end of the scale. As the utilised scale was an odd number scale, the '4' on the scale offered a midpoint or neutral response by considering the expression of 'neither-nor' for the participants.

The positions of the numbers on the scale were defined to each participant verbally during the rating process of eleven basic colours (see Section 4.10.4). Table 4.10 displays the written form of the verbally defined positions of the numbers on the 7-point rating scale.

Table 4.10 The positions of the numbers on the seven-point rating scale

Left Pole (X)		**Right Pole (Y)**	
1	extremely X	7	extremely Y
2	quite X	6	quite Y
3	slightly X	5	slightly Y
4	neither X nor Y		

The terms '*extremely*', '*quite*' and '*slightly*' were associated with the degrees of intensity of the elicited idiosyncratic attitudes of the participants. The information relating scale positions to quantifying terms were repeated as needed to the participants verbally during the ratings of eleven basic colours.

4.9.3.3 Set of Colours

In the RGT a set of elements is used to compare systematically to determine an individual's constructs. Therefore, choosing the right set of elements is considered as a crucial aspect of doing a grid. In order to determine the kinds of constructs that are obtained, the elements should be within the range of convenience and representative of the area being explored.

As this research was based on investigating the ways in which participants construe/give meaning to perceived colours in their own words, the elements were selected as eleven basic colours by the researcher. The key underlying assumption of selecting eleven basic colours was that they fully represented the range of colours (see Section 4.7) and reflected the context of the research. The purpose was to elicit the participants' personal attitudes about perceived colours by asking them systematically to distinguish between these eleven basic colours. In the grid format, the set of colours were placed between the left and right hand pole and alongside the top of the grid (see Figure 4.9).

[IP] TUTUM SOL	SİYAH	GRİ	BEYAZ	SARI	TURUNCU	KIRMIZI	PEMBE	MOR	KAHVERENGİ	MAVİ	YEŞİL	[EP] TUTUM SAĞ
	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	

Figure 4.9 The positions of eleven basic colours in the grid format (in Turkish)

Each basic colour was coded with a number in the grid format; such as 'R1' which symbolised the first colour in the set. Although the participants saw the samples of eleven basic colours in the viewing cabinet with the same sequences that were written on the participants' grids, their corresponding terms were written above the given numbers of eleven basic colours for reminding purposes only, as well.

4.9.3.4 Left Pole and Right Pole

In order to understand the way in which the participants think of/construe/give meaning to eleven basic colours in their own words, it was necessary to found out the participants' personal constructs. The participants' ways of distinguishing similarities in and differences between eleven basic colours were their personal constructs. As the construct is defined as a bipolar similarity-difference judgement, every construct has to have two opposite ends which are known as poles, the left-hand pole and the right-hand pole. In the scope of this research, the elicited personal constructs of participants were considered as their personal attitudes. Therefore, the poles in the grid format were labelled as '*attitude right' ('tutum sağ')* and '*attitude left' ('tutum sol')*. Figure 4.10 shows the original grid of P29 with her recorded personal attitudes on the left-hand and right-hand poles during her dyadic interview procedure.

	[IP] TUTUM SOL	SİYAH	GRİ	BEYAZ	SARI	TURUNCU	KIRMIZI	PEMBE	MOR	KAHVERENGİ	MAVİ	YEŞİL	[EP] TUTUM SAĞ
		R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	
← R1. R11 →	sönük	2	1	7	7	6	4	3	4	2	4	6	parlak (F)
	iyimser	7	7	1	1	1	4	1	6	6	3	2	karamsar (D)
	dürtüm - statik	1	1	1	7	6	6	2	4	4	3	6	enerjik - dinamik - hareketli (F-D)
← R2. R6 →	doğal	7	7	7	4	3	6	6	4	1	1	4	yapay (G)
	yumuşak	7	4	1	4	4	7	2	6	7	3	4	sert - katı (G)
	çekinik	7	1	7	7	5	7	2	4	2	4	3	baskın (F)
← R7. R4 →	sakin	4	2	4	7	6	7	2	3	2	2	4	uyarıcı (F-D)
← R3. R8 →	koyu	1	4	7	4	4	4	6	3	2	4	5	açık (F)
	karanlık	1	3	7	7	7	4	6	3	2	4	5	aydınlık (D)
	yabancı	3	4	7	7	7	6	2	2	7	7	4	aşina (D)

Figure 4.10 The elicited original grid of P29 (in Turkish)

As seen in Figure 4.10, the left pole and right pole of each attitude were placed on either side of the grid and working downwards row by row. The right-hand pole was the emergent pole (EP) and the left-hand pole was the implicit pole (IP) of the personal attitudes of P29. The emergent poles of the grid were the parts of the elicited attitudes to which the participant explicitly refers to distinguish between the presented sets of dyads. The implicit poles of the grid, on the other hand, were the parts of the elicited attitudes which were left tacit by the participant. The tacit attitudes were obtained generally by asking the opposite or contrast of the emergent poles (see Section 4.10.4). The result of the combination of two poles was the bipolar attitudes of the participant. In the grid of P29 (see Figure 4.10), the elicited attitudes were read by inserting the words '*as opposed to*' in the place between two poles; for instance, *parlak (bright)* as opposed to *sönük (dim)*, *karamsar (pessimistic)* as opposed to *iyimser (optimistic)* and so on.

During the interview of each participant, the presented dyads of colours were noted down with their given codes (see Section 4.10.3.3) on left-hand side - near the implicit (left) pole - near to the first row of the elicited attitude of each dyad of his/her grid by the researcher. By doing this, the number of dyads that were utilised for each participant and attitudes that were elicited for each set of dyad were understood.

In the original grid of P29 (see Figure 4.10), four randomly drawn sets of dyads were utilised for elicitation and a total of ten bipolar idiosyncratic attitudes of her were obtained, subsequently. Each set of dyad was noted down to her grid near the first elicited implicit pole of that dyad. During her interview, when P29 said the presented two colours were different, then the researcher labelled these two colours by putting arrows in opposite directions near them; such as ← *R1.R11* → (see Figure 4.10). When P29 said the presented two colours were alike, then the researcher was labelled these two colours by putting a combination curve under them; such as *R2.R6* (see Figure 4.10). As seen in the original grid of P29, only one presented set of dyad was seen to be both alike and different (i.e. R2 and R6) and the rest of the three sets of dyads were seen to be different.

4.9.3.5 Ratings

The result of the interviewing was the list of dichotomous attitudes (see Figure 4.10) that each participant used to distinguish between the set of eleven basic colours (see Section 4.10.3.3). The elicited personal attitudes of each participant told how he/she thought and construed eleven basic colours in his/her own words. However, in order to understand the exact representations of what each participant wanted to express about each basic colour, the rating process was provided to be performed on the attitudes that were elicited during the interview.

In the rating process of the procedure, the participants were asked to rate each elicited attitude on each basic colour in turn on a 7-point rating scale (see Section 4.10.3.2). Therefore, in the grid format, the ratings were placed inside the grid, between the left and right-hand poles which were working downwards row by row, attitude by attitude (see Figure 4.6).

As seen in Figure 4.10, P29 was asked to complete her grid using a scale running from 1 to 7 and rating each attitude on eleven basic colours. For instance, in the first row of the original grid of P29 (see Figure 4.10), the attitude *sönük (dim)* as opposed to *parlak (bright)* formed the extremes of this row. The attitude *dim* on the left hand pole stands for the '1' end of the scale and the attitude *bright* on the right hand pole stands for the '7' end of the scale. The ratings of eleven basic colours inside the grid show which end of the scale the elicited attitude *dim-bright* was nearest to. In accordance, the colour *grey (R2)* was rated as '1' which means that it is *extremely dim*. The colours *black (R1)* and *brown (R9)* were rated as '2' which means that they are *quite dim*. The colour *pink (R7)* was rated as '3' which is *slightly dim*. The colours *red (R6), purple (R8)* and *blue (R10)* were rated as '4' which means that they are *neither dim nor bright*. The colours *orange (R5)* and *green (R11)* were rated as '6' which are *quite bright*. The colours *white (R3) and yellow (R4)* were rated as '7' which means that

they are *extremely bright*. Subsequently, each elicited attitude on the grid of P29 was rated on each basic colour in turn before moving to the next attitude.

4.9.4 Dyadic Elicitation Procedure of the Experiment and Ratings of Colours

This thesis intends to explore the ways in which the participants construe eleven basic colours by eliciting their personal/idiosyncratic attitudes. The experiment was thus conducted for this purpose of determining the participants' ways of construing eleven basic colours verbally and exploring the structure and interrelations of the elicited attitudes of participants between these perceived colours. The RGT was considered to be an efficient method in terms of the purposes of this research. The purpose of utilising the RGT as a method was concerned with eliciting participants' ways of distinguishing similarity and/or differences between eleven basic colours in their own words. For the elicitation of idiosyncratic/personal attitudes of the participants, the dyadic method was used.

The method of the RGT was a combination of interview technique and a rating method. The interview procedure was carried out as a single-participant, face-to-face interview[52], during which the questionnaire was managed personally to the participant. During the face-to-face interviews of the experiment, the participants were not given the questionnaire to be answered; the researcher administered the questions verbally through the course of personal interview of each participant. Although the personal interviews were in the form of dialogues which were unique for each participant, the technique of asking the questions were structured and predefined as employed in the RGT.

As the face-to-face interviewing aimed at eliciting the idiosyncratic attitudes of each participant, a subsequent rating process was of great importance to derive the mathematical relationship between the participant's elicited attitudes and eleven basic colours. This mathematical description provided the exact representation of what the participant wanted to define about each basic colour. Therefore, the data collection of the experiment consisted of two procedures, using dyadic interview method to elicit the participants' personal attitudes towards eleven basic colours in their own words, and rating processes of each basic colour on the participants' own elicited scales defined by the two attitude poles.

The data collection of the experiment started in 22.03.2011 and was completed in 09.05.2011 with the participation of 60 undergraduate students (see Section 4.9) of METU Faculty of Architecture. The participants contributed to the experiment voluntarily. The procedure was conducted in an office in METU Faculty of Architecture which was referred to as the experiment room. The experiment was carried out with the utilization of the viewing cabinet that was situated within this experiment room (see Section 4.5). Eleven basic colour samples in size A6 (148 x 105 mm) which are black, grey, white, yellow, orange, red, pink, purple, brown, blue and green, were used as stimuli for the experiment (see Section 4.7). The viewing cabinet was utilised for creating a reliable viewing condition for colours to be perceived under a consistent light because the colour samples was presented in this cabinet during the dyadic interview procedures and the ratings of colours.

Each participant was individually invited in the experiment room according to the timetable of him/her that was scheduled before. Each participant was seated at a desk on which the viewing cabinet was situated with a viewing distance of 115 cm from the participant's seat to the outer back surface of the cabinet. Inside the viewing cabinet, eleven basic colour samples were placed on a grey surrounding at L^* of 50 and illuminated by D65 simulator (see Section 4.5). Before the dyadic interview procedure, each participant was shown a total of ten Ishihara colour test plates on the notebook screen to test whether the participant had colour vision deficiencies (see Section 4.8). After determining that each participant had a normal colour vision, the researcher recoded the date

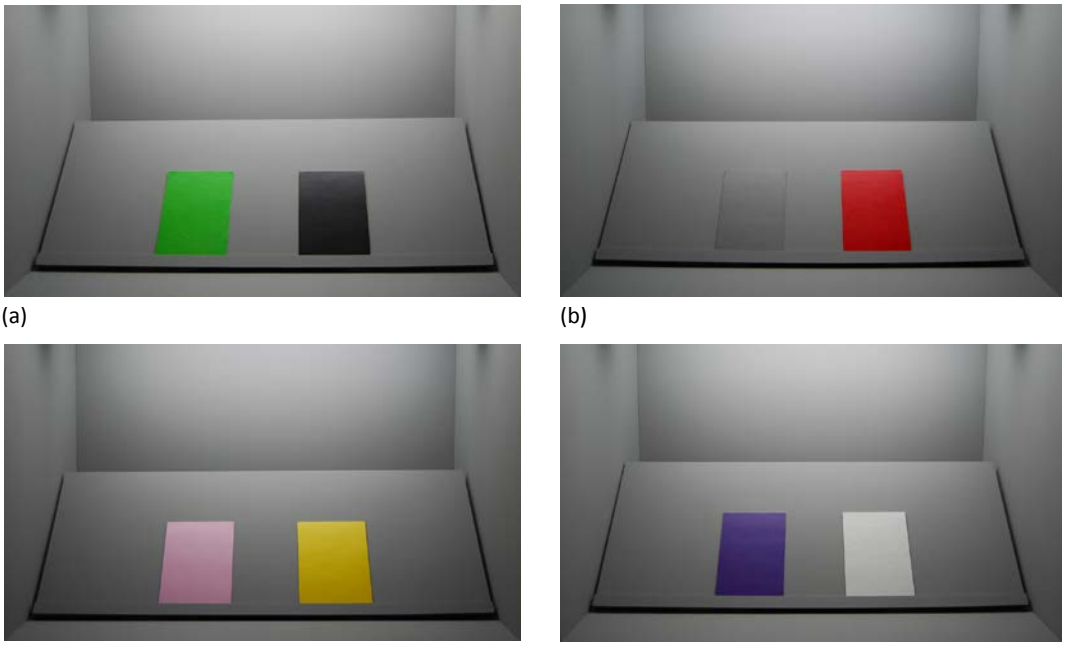
[52] Face-to-face interviews are defined as Paper and Pencil Interviews (PAPI) in which the researcher/interviewer sets down the answers on paper as the interview proceeds (De Vaus, 2002).

of the interview, the participant's number, his/her age, gender and department onto the grid format of that participant (see Section 4.10.3.1). Then, a brief explanation was given to the participant upon what was expected during the experiment verbally as in Table 4.11 (see Appendix D for Turkish explanation of the experiment).

Table 4.11 A brief explanation of the dyadic procedure that was given to the participants verbally

This is an interview. This study is based on to understand your way of interpreting and construing these (in the viewing cabinet) eleven basic colours in your own words. Therefore, in order to understand how you perceive these colours, I need to find out your personal attitudes. I am going to do it by presenting two colours at a time in the viewing cabinet randomly and asking you whether they are alike or different. After specifying they are alike or different, I am going to ask you what it is that makes these two colours alike or different and what sort of attributes make these two colours alike or different. Alikeness or differences of the two colours may result from their physical properties and/or they may remind you of or connote something and/or having some meanings for you and/or arousing a feeling. I expect you to deliver all of these attitudes according to the presented two colours in the form of phrases or adjectives. While eliciting your attitudes verbally, I am going to write them down on the right-hand pole of the format. Then, I am going to ask you the opposites of them and I am going to write them down on the left-hand pole of the format. By this way, I am going to obtain the list of your personal bipolar attitudes in order to be used to distinguish between eleven basic colours. Afterwards, I am going to put all the colours in the viewing cabinet and request you to rate each colour in turn on your own elicited attitudes running from 1 to 7. I am going to inform you later how you will rate the colours in detail during the rating process. After finishing the rating process, I am going to present another two colours at a time in the viewing cabinet and the same processes are going to repeat until you can't offer any new attitudes. There is no time limit. You can cease the interview any time when you get bored or tired. During the interview process I am going to guide you by asking some questions. I am not looking for the correct answers; I am just interested in how you interpret the presented two colours and they are specific to you. I would like you to construe these eleven basic colours as they are seen to you by not imagining any kinds of, for instances; blues or reds or pinks or greens and etc. Lastly, you may see the presented two colours both alike and different, so you are free to specify them both alike and different.

After each participant was given a brief explanation, the researcher carried out a quick demonstration of the dyadic elicitation procedure with pens. For demonstration, colours were not preferred to be used, in order not to interfere with the uniqueness of the elicited idiosyncratic attitudes of each participant. Then, each participant was left free for a few minutes to familiarise him/herself with eleven basic colours in the viewing cabinet. When the participant was ready, the elicitation procedure started with presenting the first dyad of colours and continued with successive dyads until the participant was unable to produce new attitudes. Each participant's interview and rating sessions were recorded with the utilisation of the voice recorder equipment (see Section 4.5).
The dyadic elicitation interview and the rating of eleven basic colours are described and defined in detail by exemplifying the interview session of P29. For the elicitation of personal attitudes of P29, randomly drawn (see Section 4.6) four sets of dyads from eleven basic colours were utilised (see Figure 4.11).



(a) (b)

(c) (d)

Figure 4.11 Randomly drawn four sets of dyads used in the interview procedure of the P29: (a) 1st dyad - black and green; (b) 2nd dyad - grey and red; (c) 3rd dyad - pink and yellow; (d) 4th dyad - white and purple

The interview of P29 was started by presenting the first dyad which was black and green (see Figure 4.11a). Table 4.12 displays the extracted transcript from the interview between P29 and the researcher for the first dyad. This transcript was extracted in Turkish primarily (see Appendix E) because the experiment was carried out the participant's native language, i.e. Turkish. Then, the transcript of P29 for the first dyad was translated into English by the researcher.

Table 4.12 The dialogue between P29 and the researcher during the interview for the first dyad

	FIRST DYAD: BLACK & GREEN
R:	"Do you think are these two colours alike or different?"
P:	"They are different."
R:	"How are these colours different? Or what is it do you think that makes these colours different?"
P:	"I can say **brightness**. Absolutely there is no such a thing in black but green is brighter than black. Also they give me different feelings. Black is very **pessimistic** and green gives me more **energy** than black."
R:	"Do you here want to say that energetic as opposed to pessimistic? Or do you want me to take energetic as another attitude?"
P:	"No, I think **optimistic** as opposed to pessimistic. So energetic should be taken as another attitude."
R:	"According to what sort of attribute do you think the green is bright?"

Table 4.12 (cont'd).

P:	"I think it is because of its physical attribute."
R:	"So what do you think as the opposite of bright?"
P:	"It probably is **dim**."
R:	"As you specify before, I am taking pessimistic as an emotional attribute. So according to what sort of attribute do you think green is energetic?"
P:	"Because it is bright."
R:	"What do you think as the opposite of energetic?"
P:	"It probably is **static**."
R:	"So I am taking this attitude as static as opposed to energetic. However, I think I understand what you mean, just to make sure, what do you mean by saying energetic? Would you please try to define what you have in mind?"
P:	"Actually, black seems like it stops me but green makes me move. I think I mean green is dynamic.
R:	"So, you are trying to say green is **dynamic** rather than energetic and black is static."
P:	"Yes."
R:	"Are there any other differences?"
P:	"Nothing else in my mind to say about these two colours."
R:	"Ok, thank you. Before moving on to next dyad, in order not to forget your thoughts that are elicited from these two colours, I would like you to rate these eleven basic colours in turn on your own elicited bipolar attitudes on a seven-point scale. Please give each of the colours one of the numbers, 1, 2, 3, 4, 5, 6, or 7 to say which end of the scale they are nearest to. Such as; 'dim' on the left-hand pole stand for the '1' end of the scale and 'bright' on the right-hand pole stand for '7' end of the scale which defines their extremes. The '4' in the middle of the scale has the expression of 'neither dim nor bright'. The numbers '2' and '3' represent the expression of 'quite' and 'slightly', respectively, of the adjective 'dim' on the left-hand pole and the numbers '6' and '5' represent the expression of 'quite' and 'slightly', respectively, of the adjective 'bright' on the right-hand pole. How do you rate black, accordingly?"
P:	"When I compare black with other colours."
R:	"No, I would like you to take each colour independently."
P:	"I think black takes '2'."
R:	"Now I would like you to rate each colour in turn, accordingly."

For the first dyad, the presented two colours were seen to be different by P29 and three bipolar attitudes were elicited, accordingly; i.e. *dim-bright*, *optimistic-pessimistic* and *static-dynamic*. P29 rated each elicited attitude on each basic colour in turn before moving on to the next dyad of colours. Then, the second dyad was presented in the viewing cabinet (see Figure 4.11b) and the same interview procedure was performed. The second presented dyad was seen to be both alike and different and three bipolar attitudes were elicited, accordingly; i.e. *natural-artificial*, *hard-soft*, and *recessive-dominant*. Again, P29 rated each elicited attitude on each basic colour in turn before moving on to the next dyad of colours. After that, the third dyad was presented in the viewing cabinet (see Figure 4.11c). The third presented two colours were seen to be different and only one bipolar attitude was elicited; i.e. *soothing-disturbing*. P29 rated each basic colour on her elicited bipolar attitude before moving on to the next dyad. Then, the fourth dyad was presented in the viewing cabinet (see Figure 4.11d). The presented two colours were seen to be different by P29 and three bipolar personal attitudes were elicited, accordingly; i.e. *dark-light*, *dark-luminous*, and *unfamiliar-familiar*. Again, P29 rated each elicited personal attitude on each basic colour in turn. After the fourth dyad, P29 stated that she begun to repeat herself and had difficulty in eliciting new attitudes. For this reason, the dyadic interview procedure was ceased. Consequently, a total of ten bipolar personal attitudes were elicited by utilising four sets of dyads. The interview session took 26 minutes except the colour blindness test and the explanation of the experiment.

The purpose of the face-to-face interviewing that is employed in the RGT was to qualitatively elicit the extremes of two poles by utilising the dyadic procedure. For instance; the dyad of *black* and *green* was presented to P29 and she was expected to elicit her thoughts about these two colours. She specified these two colours as different and the *dim-bright* dichotomous attitude was obtained according to the comparison of these two colours. Although the attitude *bright* on the emergent pole and the attitude *dim* on the implicit pole were the result of perceiving *green* as extremely *bright* and *black* as extremely *dim* during the interview, their ratings did not have an extreme rating of '1' or '7' when this attitude was rated on each colour in turn (see Table 4.12 and Figure 4.10). In doing ratings of eleven basic colours, the elicited dichotomous attitude of P29 during the interview was resulted in a rating response scale. Thus, the method of ratings of eleven basic colours gave the precise statement of what the participants wanted to state about each basic colour.

In doing interviewing, in order to elicit a wide variety of idiosyncratic attitudes at different levels from each participant, the three elicitation methods were adapted to be used which are already employed in the RGT. The first method was *dyading*, which involved selecting two colours at random, presenting them in the viewing cabinet at a time and asking the participant to construe these two colours in adjectives or phrases on how these two colours were alike or different. This question was repeated for different dyads until the participant was unable or unwilling to produce new attitudes.

The second method was *laddering*, which involved the process of eliciting the first attitudes in the standard manner, i.e. dyading, and then asking the participants 'Why?' The purpose was to generate new attitudes that superordinated the first attitude. In the interview of P29, for instance, she was asked "*why is green energetic?"* The answer P29 gave was "*because it is bright"* (see Table 4.12). Although a superordinate attitude was expected to elicit, the first attitude that was elicited from dyading, was repeated. The reason for this was that P29 was already at the superordinate level because there was nothing more superordinate for her up the ladder the word *energetic*. This method is considered as the structured interview procedure which was used as much as needed to generate new attitudes during the interview of P29 and during the interviews of all the participants.

The third method was *pyramiding*, which involved the process of eliciting subordinate personal attitudes by asking the participants 'What?' For instance, P29 was asked "*what do you mean by saying energetic?*" in her interview because the researcher had to be sure of what P29 really had in mind. Then, she replied by starting to describe two colours and saying "*I mean green is dynamic*" (see Table 4.12). By doing this, P29 was motivated to generate subordinate attitude. This method

was used to make the elicited personal attitudes more concrete during the interview of P29 and during the interviews of all the participants, when they were seen as abstract by the researcher.

During dyading, laddering and pyramiding, the personal attitudes of each participant that were elicited should be explicitly bipolar because the emergent pole that was stated could only exist by comparing with its implicit pole. For this, the *opposite method* was used because both poles of the attitudes were not always available. When the presented two colours were seen to be alike by the participant, asking the participant directly for the opposite of the emergent pole was the way of eliciting the implicit pole of his/her attitudes. However, while the presented two colours were seen to be different by the participant, although this led the participant to elicit his/her attitudes by comparing the differences of two colours which already gave the contrast poles of the attitudes, asking for the opposites of the elicited poles were preferred. The reason was during the comparison of two colours, the participant might give the pole of another attitude instead of the contrast of the emergent pole. For instance, during the elicitation interview of P29 for the first dyad, i.e. *black* and *green* (see Table 4.12); she specified these two colours as different. She, then, compared *black* and *green* by defining black as *pessimistic* and green as *energetic*. In order to be sure that the elicited two poles were their (pessimistic and energetic) opposites, the researcher asked the participant "*do you want to say that energetic as opposed to pessimistic?*" Then, P29 stated that *optimistic* was the opposite of *pessimistic*, accordingly. Thus, the word *energetic* was taken as another personal attitude and written down to the emergent pole side of her grid (see Table 4.12). The purpose was to elicit two clearly contrasted poles that should represent the participant's understanding and what he/she really had in mind while construing the presented two colours.

The methods that were used in the elicitation procedure of the participants are visualised in Figure 4.12. Although the method of dyading was used as the standard elicitation procedure in the experiment, the methods of laddering and pyramiding were used as supportive procedures to force the participants to produce new attitudes. Except dyading, there were no sequences of applying the other methods; they were performed as they were needed during the elicitation interview of each participant. Since laddering and/or pyramiding were not the standard procedures of the experiment, the opposite method was utilised as the standard procedure, as well, in every step of the interview, whether doing dyading, laddering, or pyramiding, in order to elicit explicit bipolar idiosyncratic attitudes of the participants.

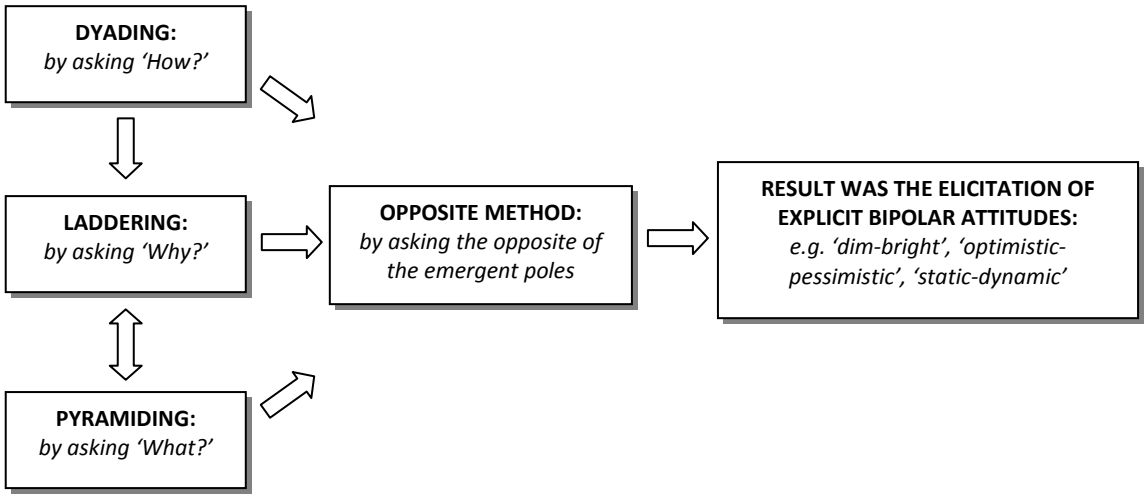


Figure 4.12 Methods used for the elicitation of bipolar personal attitudes

In sum, Table 4.13 summarises the experiment that was done to explore the participants' ways of construing eleven basic colours in their own words. The steps between 1 and 6 were the same for

each participant. However, the steps 7, 8 and 9 were repeated as needed until the participants were unable or unwilling to elicit new attitudes. As has already been stated, each elicitation interview was unique for each participant. In other words, the number of dyads that were used and the number of bipolar attitudes that were elicited accordingly depended upon the performance of each participant during his/her interview. However, for each participant, at least two dyads were concerned to be used and at least five or six bipolar personal attitudes in all were concerned to be obtained during the procedure.

Table 4.13 Summary of the sequences of the experiment

Steps	Sequence of the Experiment
1.	Each participant was individually invited to the experiment room and was seated at a desk where viewing cabinet was situated
2.	Ten Ishihara colour test plates were shown to each participant to determine whether he/she had colour vision deficiencies
3.	Demographic features of each participant was recorded on his/her grid format
4.	A brief explanation was given to each participant about the procedure verbally
5.	A quick demonstration of the dyadic elicitation procedure was done
6.	Each participant was left free for a few minutes to familiarise him/herself with eleven basic colours in the viewing cabinet
7.	Randomly drawn two colours were presented in the viewing cabinet at a time
8.	The methods of dyading, laddering, and pyramiding were performed for the elicitation of each participant's idiosyncratic attitudes
9.	Each participant was asked to rate each elicited attitude of his/her on each basic colour in turn

4.10 Role of the Researcher in the Experiment

During the face-to-face interview and the ratings of eleven basic colours in the experiment, the researcher was directly involved in the interview of each participant in the sense of internal dialogue and it was considered as a social process. The reason for this, the researcher was in the situation to draw on the conversational skills in order to understand the meanings that the participants wanted to express by means of eliciting their personal attitudes. Therefore, the most important role of the researcher in the experiment was to negotiate meanings of the elicited personal attitudes towards perceived colours with each participant during his/her interview. The reason for negotiation was to ensure what each participant really had in mind while he/she was construing eleven basic colours and eliciting his/her idiosyncratic attitudes, accordingly. Therefore, some negotiation procedures already suggested by Fransella, Bell and Bannister (2004) and Jankowicz (2004) for the application of the RGT, were used in the experiment.

Since the dyadic interview procedure was based on to obtain a truly bipolar expression of the personal attitudes from each participant, the opposite method (see Section 4.10.4), as has already been stated, was used in every step in the interview by asking directly the opposite pole of the stated personal attitudes. The purpose was to ensure what the participant had in mind by the help of

eliciting his/her tacit attitudes. The reason for this was that, the tacit attitudes provided to understand the participant's construction system and the exact meaning that the participant conveyed. For instance; in her interview, P29 (see Table 4.12) was asked to state the opposite of *energetic* and P29 replied by saying "*it is static*". Although logical opposites was not sought for, the given answer by P29 led the researcher to question what exactly she meant by stating the word *energetic*. By doing pyramiding, P29 generated subordinate meaning of the stated emergent pole, i.e. *energetic*. The debate and negotiation between the researcher and P29 resulted in clarifying her bipolar personal attitude as *static* vs. *dynamic*. The important thing in the interview was to elicit attitudes that made sense to both the researcher and the participant because the elicited superordinated/subordinated/rephrased words with the same meaning would be more effective than the words that were stated before.

Fransella et al. (2004) and Jankowicz (2004) suggest that the researchers should feel free to discuss what the participants mean without distorting or imposing attitudes/constructs. This was the reason of offering P29 (see Table 4.12), for instance, to be taken the word *energetic* as another attitude for the emergent pole of her grid rather than accepting it as the opposite of the word *pessimistic* (see Section 4.10.4). Although, again, it was not trying to find out the logical opposites, the attitude *energetic* as opposed to *pessimistic* was something rather different in meaning than the attitude *optimistic* as opposed to *pessimistic*. In other words, during the ratings of eleven basic colours, the ratings of colours would be different when the bipolar attitude of P29 would be accepted as *energetic* vs. *pessimistic* than *optimistic* vs. *pessimistic* or vice versa. Again, the important role of the researcher in RGT was to obtain what the participants wanted to convey by eliciting their attitudes towards eleven basic colours.

During the interview process of each participant not all elicited attitudes were useful, in other words, they were not significant to the purpose of the research. For instance, the attitudes *like* vs. *dislike* and *preferable* vs. *not preferable* did not provide useful information because the range of convenience of these attitudes was too wide and subjective in order to clearly distinguish between eleven basic colours. These general constructs are called by Hunt (1951[53]; cited in Fransella et al., 2004,) as "excessively permeable constructs" (p. 24). In this situation, the researcher utilised the methods of dyading and/or laddering by asking the participant "*What is it that makes you like or dislike these two colours?*" Or "*In what way or why, do you like or dislike these two colours?*" Or "*What is it that makes you to prefer or not to prefer these two colours?*" Or "*In what way or why, do you prefer or not to prefer these colours?*" Besides the permeable attitudes, some elicited attitudes could also be superficial or vague. For instance, when the participant said "*These two colours are alike because they are similar or analogous*", or when the participant said "*These two colours are different because they are opposite or contrast*", the researcher asked the participant to state "*What is it that makes these two colours similar or analogous?*", or "*What is it that makes these two colours opposite or contrast?*" Although the participants' ways of construing perceived colours might be by distinguishing the colours as employed in colour theory, (such as; the similar hues, i.e. orange and red or blue and green, which are adjacent to each other on the colour wheel are called as analogous colours; two hues, on the other hand, which are directly opposite in direction to each other on the colour wheel, i.e. orange and blue or red and green, are called as contrast colours in colour theory), further clarification was necessary for the colours that were stated by the participants as being *similar/analogous* vs. *opposite/contrast*. The reason for this was that, as the purpose of the experiment was already based on distinguishing eleven basic colours according to their alikeness and/or differences, the range of convenience of the attitude *similar/analogous* vs. *opposite/contrast* was narrow and superficial. In other words, during the rating process, this attitude would not be rated on to the other colours in turn in the set except the presented particular dyad. Consequently, using the elicitation techniques of dyading and/or laddering in these situations, i.e. permeable, superficial and vague attitudes, or not useful attitudes for the purpose of the research, could offer the participant to produce superordinated or rephrased attitudes. Whenever the participant could

[53] Hunt, D. E. (1951). *Studies in role concept repertory: Conceptual consistency*. Unpublished MA Thesis, Ohio State University, Columbus, Ohio, USA.

not offer any attitudes in above mentioned situations for a particular presented dyad of colours in his/her interview, the researcher dropped that dyad and offered another dyad of colours.

The researcher was not only involved in the elicitation process of the experiment but was also involved during the rating process of eleven basic colours. Since the idiosyncratic attitudes of each participant were elicited for the particular dyad of colours, the participant was asked to rate each attitude on each basic colour in turn before moving on to next dyad of colours, as has already been stated (see Section 4.10.4). During the ratings of colours, the participants were asked to call out a rating because the researcher filled in the grid matrix, not the participant. This was both to prevent the participant from comparing the ratings of eleven basic colours with each other and to avoid the colours to be rated in groups. By this way, the participant was interfered by asking, for instance, "*Is yellow as bright as white or less so?***"** (see Figure 4.10) and to preserve the directionality of the scaling by making sure that the participant did not use '1' when he/she was offering '7' and vice versa. Consequently, the interview and the ratings of eleven basic colours in the experiment were the two-way process which the researcher was directly involved.

CHAPTER 5

ANALYSIS PROCEDURES AND RESULTS OF THE ATTITUDINAL APPROACHES OF INDIVIDUALS TOWARDS PERCEIVED COLOURS

The major aim of this research is to explore the attitudinal approaches of individuals towards perceived colours. The research thus was formulated to find an answer to the question: How do individuals think of/give meanings to/construe the perceived colours in their own words? For this, the experiment (see Chapter 4) was conducted with 60 participants with the utilisation of the Repertory Grid Technique (RGT). As the result of the experiment, 60 repertory grids, which included the list of personal bipolar attitudes of each participant in order to be used to distinguish between the set of eleven basic colours and the ratings of these colours on elicited attitudes, were obtained from the participants.

This chapter, consequently, is mainly based on analysing the elicited raw data of 60 participants qualitatively with the utilisation of content analysis procedure. As the first step of this research (see Section 4.1) intended to determining the ways in which the participants construe eleven basic colours by eliciting their idiosyncratic/personal attitudes in their own words, the objectives of the analyses include,

- to examine each participant's own elicited idiosyncratic/personal attitudes; and
- to explore the interpersonal relations of the common elicited attitudes.

In accordance, the mean and the standard deviation of the resulted data are calculated in order to describe the data numerically and to make some observations about the ways in which the attitudes are used. The internal consistency reliability of the resulted data is assessed by utilising Cronbach's Alpha method in order to find to what extent the elicited repertory grid data is consistent, as well.

5.1 Content Analysis of the Repertory Grid Data

Content analysis is considered as a scientific tool which is used for the procedure of evaluating the content of all forms of recorded materials in a systematic and objective way (Kolbe and Burnett, 1991; Krippendorff, 2004). The purpose of content analysis is mainly to analyse the text data, which might be in verbal form and/or might have been obtained from survey questions, interviews and observations, by investigating the content or contextual meaning of the text (Hsieh and Shannon, 2005). In accordance, Krippendorff (2004) defines content analysis as "[…] a research technique for making replicable and valid interferences from texts (or other meaningful matter) to the contexts of their use." (p. 18). Weber (1990), Krippendorff (2004) and Green (2004) explain this definition as follows;

- When applying the same technique of the content analysis to the same data, the result should be the same with the researchers that work at different points and under different circumstances. Thus the resulted data should be able to be replicated by other researchers.
- The findings from the content analysis should also produce valid results. In other words, the variables that are generated during the classification procedure of the data should measure or represent what the researcher claims to measure.

- Content analysis is not limited and restricted to written materials and/or textual data only; works of art, images, maps, sounds, signs, symbols and numerical records should also be used as data which Krippendorff (2004) states as "or other meaningful matter" in his definition. Thus the word *text* is used in content analysis as a general term which includes all forms of recorded materials.

The key idea behind the content analysis is to classify the words of the text into reliable content categories. Each category may consist of several words or phrases which is classified according to their having similar meanings, i.e. the words that have precise meaning like synonyms or the words that share similar connotations to the same concept, etc. (Weber, 1990). Although interpreting the content and contextual meaning of the text data is subjective, systematic classification procedures, as employed in content analysis, such as frequency count of the words in the text and/or coding and identifying themes or patterns of the text, make it a scientific method (Green, 2004; Hsieh and Shannon, 2005). Therefore, content analysis is considered as a both qualitative and quantitative method. It is qualitative because it includes inductive reasoning and it usually produces descriptions about how individuals view the world by examining the meanings underlying their physical messages. On the other hand, it is quantitative because it includes deductive reasoning and it produces numbers to be used with various statistical techniques (Zhang and Wildemuth, 2009). According to Smith (1975; as qtd. in Zhang and Wildemuth, 2009, p. 309), in content analysis, "qualitative analysis deals with the forms and antecedent-consequent patterns of form, while quantitative analysis deals with duration and frequency of form." Hence, depending on the purpose of the research, content analysis is used as either qualitatively or quantitatively. Weber (1990; as cited in Zhang and Wildemuth, 2009) suggests that, these two approaches should be used in combination in order to do quantitative analysis of qualitative data (Hsieh and Shannon, 2005).

In this research, in order to explore the attitudinal approaches of the participants towards eleven basic colours, both the qualitative and quantitative applications of content analysis were conducted on the repertory grid data which was obtained during the structured interviews of 60 participants. Qualitative content analysis was used primarily to investigate the content and contextual meaning of the repertory grid of each participant, and secondarily to explore the common attitudes in the group context. On the other hand, quantitative content analysis was conducted for the systematic descriptions of the data by doing frequency counts of the elicited attitudes in both participant and group level and by calculating the mean and standard deviations of them.

5.1.1 Examination of Each Participant's Idiosyncratic/Personal Attitudes

The text data that was conducted for content analysis was the repertory grid of each participant. The repertory grid of each participant included the list of his/her own idiosyncratic/personal bipolar attitudes and ratings of eleven basic colours on his/her attitudes. The relations between eleven basic colours as elements, elicited attitudes as constructs and ratings of these elements on constructs in the grid data showed the ways in which the participants thought of/gave meaning to/construed the perceived colours. As Jankowicz (2004, p. 71) claims "[…] the content of what is being said with the words that have been used to label the constructs, and the structure of how it has been said with the matrix ratings provided" are needed in order to understand the choice which the participant makes in his/her thinking of eleven basic colours. However, the scope of this section is based solely on examining the meanings underlying the elicited attitudes of the participants. The purpose is to convert the raw data of each participant into the data set in order to analyse the structure and/or interrelations between the eleven basic colours and the bipolar attitudes (see Chapter 6). To this end, the steps of the analyses are discussed in detail in the following subsections.

5.1.1.1 Transferring Each Repertory Grid Data into the Computer

The basis of the content analysis of the data was composed of each participant's personal attitude list that was obtained during the interview of each participant. Each participant's raw data was

transferred into the computer separately in order to be used as data sets. As the repertory grid format (see Figure 4.6) was already prepared in the form of table/matrix to be used for the dyadic interview and ratings of eleven basic colours of each participant, for the first step, the repertory grid matrix of each participant was tabulated into the computer as it was gathered and without doing any interferences (see Figure 5.1). The purpose was to compile the obtained data for content analysis.

Grid of P. # 3	Age: 24	Gender: female	Department: ID-4rd grade	Interview time: 30'

				1 ◄ Ratings of Colours ► 7												
			Attitude Left	Black	Grey	White	Yellow	Orange	Red	Pink	Purple	Brown	Blue	Green	Attitude Right	
Dyads of Clrs			Implicit Pole												Emergent Pole	Attribute
Alike	Diff.	C.#	Turkish	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	Turkish	
C8 ; C3		1	enerjik	3	4	4	2	3	1	6	6	7	3	2	dingin	Emotion
C8 ; C3		2	dikkat çekici, çarpıcı	5	7	6	3	2	1	5	6	7	3	2	çarpıcı değil, dikkat çekmeyen	Physical
	C8 ; C3	3	karanlık	1	2	7	6	5	7	4	3	2	4	5	aydınlık	Physical
	C5 ; C7	4	yapay	7	3	7	2	3	4	2	3	4	3	6	doğal	Connotation
	C5 ; C7	5	belirgin	6	7	4	2	3	1	6	5	7	3	2	kaybolan	Emotion
	C5 ; C7	6	kendi başına durabilen	1	5	6	5	3	2	6	5	7	6	7	geçiş yapabilen	Emotion
	C2 ; C9	7	hafif	7	2	1	2	3	4	2	6	7	4	3	ağır	Meaning
	C2 ; C9	8	geleneksel	4	7	6	6	5	4	6	5	1	3	4	modern	Meaning
C6 ; C11		9	donuk	2	1	7	6	5	6	2	3	1	4	2	parlak	Physical
	C8 ; C4	10	hızlı	7	6	2	1	3	2	6	5	7	4	4	yavaş	Meaning

Figure 5.1 The transferred repertory grid of P03 into the computer

The repertory grid table of P03, which is presented in Table 5.1, is an example of how each participant's manually collected data was transferred into the computer. Each participant's repertory grid was tabulated same as in Table 5.1 which included the following features. The first row of the repertory grid data included the demographic features of each participant including his/her participation number, age, gender, department and interview time. The box on the left-hand side involved the list of the dyads of colours that were presented during each participant's interview. During the interview, each participant was requested to specify the alikeness and differences of the randomly presented dyads of colours and to elicit his/her idiosyncratic/personal attitudes, accordingly (see Section 4.10.4). In accordance with each participant's way of perceiving the colours as alike or different, the presented dyads were labelled by writing them down on his/her grid manually during his/her interview (see Section 4.10.3.4). On the transferred repertory grid table of each participant, these manually noted dyads of colours with their stated alikeness or differences were recorded near to his/her each elicited personal attitude, as well. The purpose was to see clearly which of each personal attitude of the participant was elicited by which of the specified alikeness or differences of the dyads of colours.

At the right-hand side of the transferred grid of each participant (see Table 5.1), there also existed the list of the attributes that the participants specified. These attributes were obtained during the interview of each participant by asking him/her "*According to what sort of attribute makes the presented two colours alike or different?*" and were noted down manually on his/her grid. Alikeness or differences of two colours might result from their physical properties and/or they might remind the participant of or connote something and/or have some meanings for the participant and/or arouse a feeling or emotion. On the transferred repertory grid table of each participant, these manually obtained attributes were recorded near his/her elicited personal attitude, as well. The purpose was to clarify which each elicited personal attitude was the result of which of the attributes that has been stated above.

In between the list of attributes and dyads of colours on the transferred repertory grid table, the grid matrix of each participant that was generated during his/her interview was tabulated (see Table 5.1). Repertory grid of each participant was composed of the set of personal rating scales of him/her and

the ratings of eleven basic colours. The rating scales were unique for each participant and were various in numbers. The columns of the grid represented eleven basic colours as cases which were common for each participant and the rows of which contained the elicited idiosyncratic/personal bipolar attitudes of each participant as variables. Thus, each grid was the table of cases by variables data matrix with the ratings arranged in rows and columns into that table. In total, 60 repertory grids were transferred into the computer separately to be content analysed.

5.1.1.2 Focusing on the Content of Each Participant's Repertory Grid

The content and context of the repertory grid data of the participants consisted of; i. eleven basic colours, ii. the attitude poles, and iii. the ratings that were used to indicate the relationship between each basic colour and each attitude. Therefore, the repertory grid of each participant contained a very large amount of information. For instance, the transferred repertory grid data of P03 in Table 5.1 was a 10 x 11 grid which contained 142 pieces of information[54] to be analysed. The information of the repertory grid data of P03 included the relationship amongst each basic colour and amongst each personal attitude of her as well as between eleven basic colours and the elicited attitudes. All of 60 repertory grid data had similar pieces of information; however, analysing the relationship between eleven basic colours and the elicited personal attitudes in participant level is beyond the scope of this section. The focus is on investigating the meanings underlying the elicited attitudes of each participant in order to reorganise and/or manipulate the information of the transferred raw grid of each participant. To this end, qualitative content analysis is conducted for analysing the elicited bipolar attitudes of each repertory grid data.

For the second step (see for the first step in Section 5.1.1.1), the meaning of each participant's idiosyncratic/personal bipolar attitudes in his/her repertory grid is intended to be identified. The reason for that was each elicited bipolar attitude was composed of words which were used by each participant to label the meanings underlying his/her personal attitudes. In other words, each word in each participant's grid was the verbal label for expressing or communicating his/her attitude towards eleven basic colours. In order to examine the meanings underlying the elicited attitudes of each participant, the interview of each participant was audio recorded during the experiment. After transferring the raw data of each participant into the computer, each repertory grid data was checked by listening to each participant's interview. All elicited bipolar attitudes were reviewed in participant level by the researcher and the details are discussed in the following.

In the process of reviewing, firstly, the researcher was concerned with the equivalence of the word labels that were used to express the attitudes, because, the purpose was to have an agreement between the elicited attitudes and word labels. The researcher manipulated the elicited attitudes when different words were being used for the same attitude by rephrasing or omitting them from the repertory grid of each participant. For instance, in the repertory grid data of P03 (see Table 5.1), the attitudes (highlighted in Table 5.1) *dikkat çekici, çarpıcı* vs. *çarpıcı değil*, *dikkat çeymeyen* and *kaybolan* vs. *belirgin* were determined as conveying the same meaning. Although the presented dyads of colours were different and P03 elicited her attitudes accordingly, she repeated herself by using different words for the same attitude. To be sure, the ratings of these two attitudes were checked, as well. Subsequently, the attitude *kaybolan* vs. *belirgin* was omitted from the grid of P03 because it had identical ratings with the attitude *dikkat çekici, çarpıcı* vs. *çarpıcı değil*, *dikkat çeymeyen*. Accordingly, the data of P03 was resulted in a 9 x 11 grid which contained 130 pieces of data. By doing this, the repertory grid of each participant was reduced, compiled and reorganised for further analyses.

[54] The pieces of information were calculated by using the following formula: "(*n* + *m* x 2 (poles) + *n* x *m*)" (Tan, 1999, p. 938). The *m* is the number of elements which was 11 and the *n* is the number of constructs which was 10 in the grid of P03.

Secondly, the attitudes which composed of more than one words were converted to a single attitude or rephrased to a new attitude. The reason for obtaining more than one words for each attitude pole was the result of laddering. The purpose of laddering was to elicit a wide variety of idiosyncratic/personal attitudes at superordinated levels from each participant (see Section 4.10.4). However, Fransella et al. (2004, p. 17) states that "[…] very superordinate, abstract, laddered personal constructs often take longer to 'verbalise' and need more words to identify them. As Kelly says, constructs are created before they are given verbal labels." This was the reason why the participants needed more words to label their laddered attitudes. These were usually seen after eliciting the first attitude from a particular dyad of colours (see Section 4.10.4) because the first attitude was elicited in a standard way, i.e. dyading, and then asking the participants 'Why?' As seen in the repertory grid table of P03 (see Table 5.1), for instance, she was requested to ladder up her first attitude by asking her "Why are purple (C8) and white (C3) *dingin*?" P03 then laddered up her attitude *dingin* by using two words for each pole in her second attitude. The elicited attitude *dikkat çekici, çarpıcı* vs. *çarpıcı değil*, *dikkat çeymeyen* was needed to be converted to a single word according to the meaning underlying her attitude because the word *dikkat çekici* vs. *dikkat çeymeyen* was different in dictionary meaning than the word *çarpıcı* vs. *çarpıcı değil*. These word labels were determined that they did not correspond to the meanings underlying her attitude after listening to her interview from the audio recorder. Thus, these word labels were rephrased to a new word which corresponded to the meaning underlying her attitude, i.e. *göze çarpan vs. farkedilmeyen*. Subsequently, each participant's elicited attitudes with more words were rephrased to a new attitude or converted to a single attitude according to their underlying meanings. It is important to note that the single elicited attitudes were also rephrased to a new attitude when the participants' word labels did not represent the meanings underlying their elicited attitudes.

Lastly, the attitudes which did not represent what the researcher claimed to measure were omitted from the repertory grid data of each participant. In other words, the attitudes that were not significant to the purpose of this research, such as the attitudes *benzer* vs*. zıt*, *benzer* vs*. tezat*, *aynı* vs*. farklı*, and *aynı* vs*. karşıt* were omitted although they were accepted during the interview of each participant. These attitudes were accepted for not interfering with or interrupting the progress of the participants during their interviews. However, they were in the category of superficial and vague attitudes according to the purpose of this research (see Section 4.11).

Consequently, a total of 16 attitudes were omitted from a total of 15 repertory grids of the participants. These attitudes were omitted because of their vagueness and/or different words were being used for the same attitude. Two attitudes were omitted from the repertory grid of one participant which included both vague attitude and different words being used for the same attitude. The rest of 14 attitudes were omitted from the repertory grids of 14 participants because of the attitudes being vague, which means one attitude was omitted from each of 14 repertory grids. Hence, 60 repertory grids were compiled by this way for the systematic descriptions of their frequency counts.

5.1.2 Frequency Counts of Each Repertory Grid Data in Participant Level and Their Averages in Group Level

Each manually obtained repertory grid of the participant (in total 60 repertory grids) during the experiment was firstly transferred into the computer in order to be used as data sets (see Section 5.1.1.1). Secondly, each repertory grid data was reviewed by focusing on the content and contextual meanings of the elicited attitudes (see Section 5.1.1.2). These analyses steps were done in participant level and did not give much more information about the full gathered data. In order to summarise the general information of the full data, the elicited data in participant level is necessary to be described systematically and numerically in multiple participant level or can be said in group level.

As has already been stated (see Section 5.1.1.2) each repertory grid data contained a very large number of information, i.e. the relationship amongst each basic colour and amongst each personal attitude, and the relationship between eleven basic colours and the elicited attitudes. However, each data included the demographic features of each participant (see Section 4.8) and his/her interview time, the number of dyads of colours that were presented in each repertory grid interview and the number of idiosyncratic/personal attitudes that were elicited, as well. Before going into further analyses of the relationship between eleven basic colours and the elicited attitudes (see Chapter 6), the frequency counts of the interview time, the number of dyads of colours and the number of elicited personal attitudes in participant level and their averages in group level are described in the following.

Interview Time

During the repertory grid interviews and the ratings of eleven basic colours, the participants were not required a time limit. The reason was that each repertory grid interview was unique for each participant. This means, each interview varied depending on the performance of each participant. Each participant was free to cease his/her interview any time when he/she got saturated or bored. Hence, approximately 32 hours of repertory grid sessions in total were conducted in the experiment room (see Section 4.4) with 60 participants. This duration only contained the dyadic interviews and the rating processes. Hence, on average, each interview session took around 32 minutes, ranging from 19 to 60 minutes (see Table 5.1a).

Number of Dyads of Colours

For the experiment, eleven basic colours, which are black, grey, white, yellow, orange, red, pink, purple, brown, blue and green, were used as the stimuli. In the repertory grid session of each participant, these colours were randomly presented in sets of dyads in order to elicit his/her idiosyncratic/personal attitudes. Each dyadic elicitation interview was unique for each participant; therefore, the number of dyads of colours that were utilised in each session was different. A total of 228 dyadic sets of colours were presented during the experiment. On average, around 4 sets of dyads of colours were presented in each repertory grid session, ranging from 2 to 6 sets per interview (see Table 5.1b).

Number of Elicited Personal Attitudes

As has already been stated above the number of dyads of colours that were presented were different in each interview; therefore, the number of bipolar personal attitudes, or in other words, rating scales that were elicited accordingly varied, as well. This was the reason of the ways in which each participant construed and gave meaning to the presented dyads of colours in his/her own words. Hence, from 60 repertory grid interviews, a total of 606 bipolar personal attitudes were elicited. On average, each interview elicited 10 bipolar personal attitudes, ranging from 6 to 18 attitudes per participant (see Table 5.1c).

Table 5.1 The frequency distributions of the (a) interview time; (b) number of dyads of colours; (c) number of elicited bipolar personal attitudes

Interview Time (in minutes)			
Min.	**Max.**	**Total**	**Mean**
19	60	1899	31.65

(a)

Number of Dyads of Colours			
Min.	**Max.**	**Total**	**Mean**
2	6	228	3.80

(b)

Number of Elicited Bipolar Personal Attitudes			
Min.	**Max.**	**Total**	**Mean**
6	18	606	10.10

(c)

For the detailed descriptions, the list of demographic features of each participant can be found in Appendix B.

5.1.3 Exploration of the Interpersonal Relations of the Common Attitudes

During the experiment, 60 repertory grid interviews resulted in eliciting 60 individual repertory grid tables each of which contained the idiosyncratic views of the ways in which each participant construed/gave meaning to eleven basic colours. Each repertory grid table consisted of a different number of response scales (see Section 5.1.2), in other words, bipolar personal attitudes, the shared number of elements which were eleven basic colours and the shared rating system on a 7-point rating scale (running from 1 to 7) in order to rate each personal attitude on each basic colour. Although each repertory grid table provided a rich qualitative and quantitative data to be analysed separately, it was thought that these individual idiographic/personal views of each participant provided a common frame for exploring the shared attitudes. The commonality corollary (see Section 2.6) supports this idea which is defined as follows; "To the extent that one person employs a construction of experience which is similar to that employed by another, his psychological processes are similar to those of the other person" (Kelly, 1955/1991, p. 63) which is the opposite pole of the individual corollary (see Section 2.6). In accordance, Fransella et al. (2004, p. 46) state that "[…] If you are in doubt about what kind of construct are applicable to a certain group, […] you are then fairly safe in assuming that the most commonly used constructs for that group will be meaningful […]." It can be said in essence that, the interest of this research was not on the idiosyncratic views of each participant but rather on shared attitudes towards eleven basic colours in a group context. To this end, the group data was required. For this, each repertory grid table was compared with each other and analysed interpersonally. The purpose was to explore the common patterns and the relationships between the repertory grids of 60 participants. This section, henceforward, discusses the analysing processes of how to obtain the full data list of the common attitudes.

5.1.3.1 Converting Each Repertory Grid into a New Data

In order to compare 60 repertory grid tables with each other, each of it was tabulated to a new table. The purpose was to make them identical to analyse the elicited bipolar attitudes and their ratings of each basic colour interpersonally. For this, the attitude poles of each grid table were reviewed again. During reviewing, the positive word labels of the attitudes (e.g. *bright* or *harmonious*) were written on the left-hand side and the negative word labels of the attitudes (e.g. *dim* or *disharmonious*) were written on the right-hand side of the new table of each participant independent of whether they were on the emergent or implicit poles. The reason for this was to see the shared patterns of the personal attitudes.

During repertory grid interviews, each participant was presented a different set of dyads of colours and was expected to elicit his/her personal attitudes by stating the presented two colours were alike or different. After the participant stated their alikeness or differences, he/she was requested to say verbally how these two colours were alike or different. The given answer by the participant was accepted as the emergent pole of his/her attitude and was written down manually to the right-hand side of his/her repertory grid table. Then, the participant was asked the opposite pole of his/her emergent pole, the given answer was accepted as the implicit pole of his/her attitude and was written down manually on the left-hand side of his/her repertory grid table (see Section 4.10.4). In this case, suppose that the presented two colours were seen to be alike by the participant and, for instance, he/she stated that their alikeness was because of being *bright* (emergent pole) and its opposite pole was *dim* (implicit pole). Again, suppose that the different two colours were presented to another participant and they were seen to be alike as well and he/she stated that their alikeness was because of being *dim* (emergent pole) and its opposite pole was *bright* (implicit pole). In a participant context, the stated emergent or implicit poles were important to be analysed to understand his/her way of construing eleven basic colours. However, in a group context, having the

same bipolar attitudes on different attitude poles, i.e. either in emergent or implicit poles, led to have difficulty to compare the shared patterns of the attitudes with more than one participant. Therefore, the positive poles of the bipolar attitudes were listed on the left-hand side and the negative poles of the bipolar attitudes were listed on the right-hand side of the new table of each participant. When the elicited bipolar attitudes were already in the form of being positive on the left-hand side and being negative on the right-hand side, these elicited bipolar attitudes were not converted.

The ratings of eleven basic colours of the converted bipolar attitudes were needed to be transformed, as well. The reason for that was during the repertory grid interviews, the bipolar attitudes were elicited in the form of implicit pole on the left-hand side and the emergent pole on the right-hand side. For instance, suppose that the elicited bipolar attitude was *dim* (implicit pole) as opposed to *bright* (emergent pole) and the participant rated this *dim-bright* response scale on each basic colour in turn on a 7-point rating scale. The word *dim* on the left-hand pole was standing for '1' end of the scale and the word *bright* on the right-hand pole was standing for '7' end of the scale which defined their extremes. The numbers '2' and '3' represented the expression of 'quite' and 'slightly', respectively, of the adjective *dim* on the left-hand pole and the numbers '6' and '5' represent the expression of 'quite' and 'slightly', respectively, of the adjective *bright* on the right-hand pole. The '4' in the middle of the scale has the expression of 'neither *dim* nor *bright*' (see Section 4.10.3.2). Thus the bipolar attitude was rated on eleven basic colours accordingly. However, while the response scale was converted into the form of *bright-dim*, for this time, the word *bright* on the left-hand pole was standing for '1' end of the scale and the word *dim* on the right-hand pole was standing for '7' end of the scale. While the participant (see Table 5.2) rated *black*, for instance, according to the response scale as in the form of *dim-bright* and it took '2' which means it was quite *dim*, on the other hand, when the response scale was converted into the form of *bright-dim*, then the colour that had already been rated as '2' means it was quite *bright*. In order to prevent these kinds of confusions, the ratings of eleven basic colours were converted to a new rating by using the formula of '*8-n*'; *n* was the rating of each basic colour which already had. The rating of each basic colour was subtracted from '8' and the result was the new ratings of eleven basic colours. In Table 5.2, P29's original ratings of the attitude *dim-bright* on each basic colour in turn (see Figure 4.10) and its converted ratings are seen.

Table 5.2 The original ratings of P29 on the attitude dim-bright and its converted ratings

Left Attitude Pole	**Black**	**Grey**	**White**	**Yellow**	**Orange**	**Red**	**Pink**	**Purple**	**Brown**	**Blue**	**Green**	**Right Attitude Pole**
dim	2	1	7	7	6	4	3	4	2	4	6	bright

Left Attitude Pole	**Black**	**Grey**	**White**	**Yellow**	**Orange**	**Red**	**Pink**	**Purple**	**Brown**	**Blue**	**Green**	**Right Attitude Pole**
bright	6	7	1	1	2	4	5	4	6	4	2	dim

The rating scale was converted as *bright-dim* and the ratings of eleven basic colours that had already been obtained were transformed by subtracting each original rating from '8'.

The experiment was carried out with Turkish participants living in Turkey; therefore, the experiment was conducted in the participants' native language, i.e. Turkish. The verbal explanations of the elicited bipolar attitudes provided by each of the participants were reviewed in Turkish. In the

process of reviewing (see Section 5.1.1.2), the researcher manipulated the elicited attitudes when i. different words were being used for the same attitude by rephrasing or omitting them from the repertory grid of each participant, ii. more than one words were being used for the attitudes by converting them to a single attitude or rephrasing them to a new attitude, and iii. they were not significant to the purpose of the research either being vague or superficial by omitting them from the repertory grid of each participant.

In reviewing of the elicited attitudes in Turkish, online Büyük Türkçe Sözlük (http://tdkterim.gov.tr/bts/) was used for Turkish definitions and/or synonyms of the attitudes from the data base (http://www.tdk.gov.tr/) of Türk Dil Kurumu (TDK)[55]. Afterwards, a total of 606 bipolar attitudes (see Section 5.1.2) were translated into English by the researcher. In the course of the translation of the attitudes, Oxford Dictionaries online[56] (http://oxforddictionaries.com/) was used for their dictionary definitions and the thesaurus of Dictionary.com[57] website (http://dictionary.reference.com/) was utilised in order to find the synonyms and/or antonyms of the attitudes (see Appendix F). It is important to note that both Turkish and English dictionaries were used for the purpose of discovering the meanings underlying the elicited attitudes rather than their dictionary definitions. Therefore, translations were not conducted using translation-back-translation procedures.

After the reviewing and translation processes, the shared attitudes that were mentioned by several participants from a total of 606 bipolar attitudes were collated. The collation of the common bipolar attitudes were done according to their having similar meanings, i.e. the words that had precise meaning like synonyms or the words that shared similar connotations to the same attitude. In order to demonstrate how the attitudes were collated is exemplified in Table 5.3.

Table 5.3 An example of the collation of the common bipolar attitudes

In Turkish	In English
olgun—çocuksu	*mature—childish*
olgun—olgun olmayan	*mature—immature*
yetişkin—çocuksu	*adult—childish*
yaşlı—çocuksu	*old—childish*

The words of each attitude in Table 5.3 not only had similar meanings like synonyms but shared also the similar connotations to the same attitude. For this reason, these bipolar attitudes were collated and classified together. These four shared attitudes in different word pairs were categorised under the label of *mature-immature* by the researcher. The reason for this was, not only did the word *mature* subsume the words *adult* and *old*, and the word *immature* subsume the word *childish* with their dictionary definitions, but they also comprised the meanings underlying these elicited

[55] Türk Dil Kurumu (TDK) (Turkish Language Institution) was established by the order of Atatürk in 1932 with the name of Türk Dili Tetkik Cemiyeti (Turkish Language Research Association). Today, the institute is working as one of Turkey's prestigious scientific institution with more than 800 Turkish Language publications, 40 Scientific Committee members, 17 specialists, 56 employees and a rich research library. TDK is located in Kavaklıdere, Ankara (Türk Dil Kurumu, n.d.).

[56] It is the online dictionary which is copyrighted by Oxford University Press.

[57] Dictionary.com was launched in 1995 under the name of Lexico Publishing, LLC. It is the most visited (every month more than 50 million users across the globe) online English dictionary and thesaurus located in Oakland, California. It is accepted as the world's largest and most authoritative free online dictionary and mobile reference resource. It is part of IAC Corporation (dictionary.com, n.d.).

attitudes. Therefore, the attitudes *mature-childish* (*olgun-çocuksu*), *adult-childish* (*yetişkin-çocuksu*), and *old-childish* (*yaşlı-çocuksu*) were grouped under the label of *mature-immature*. When different attitudes which were referring to the same attitude were converted into the attitude *mature-immature*, it was found that it occurred about 15 times in 606 attitudes elicited from 60 participants. Subsequently, a total of 606 bipolar attitudes were collated by grouping the different words referring the same attitude together and each group was given a new label that corresponded to the meaning underlying the elicited attitudes in that group. Additional two researchers who were fluent in English were involved in this process as well and the common attitude list was finalised with the agreement of these three researchers.

5.1.4 Identification of the Common Bipolar Attitude List

In summarising the 606 bipolar attitudes elicited, 102 groups of common bipolar attitudes were listed. These groups were regarded as the most pertinent representations of the participants' ways of construing and giving meanings to eleven basic colours. The frequency count was necessary for identifying the frequency of mentioning of the participants for each group of the common bipolar attitude which are discussed in the following.

According to the interpersonal analysis of each group of attitudes, the most commonly elicited bipolar attitude was *natural-artificial*. In other words, the attitude *natural-artificial* was mentioned by 32 out of 60 participants that was 53% of the total population. This is followed by the attitude *bright-dim* which was mentioned by 27 out of 60 participants (45% of total). Next the attitude *harmonious-disharmonious* was mentioned by 26 (43% of total) and the attitude *light-dark* was mentioned by 24 participants (40% of total). Following, the attitudes *dominant-recessive* and *dynamic-static* was mentioned by 21 out of 60 participants each (35% of total). After, the attitude *warm-cool* was mentioned by 20 participants (33% of total), the attitude *conspicuous-inconspicuous* by 18 participants (30% of total), the attitude *energetic-calm* by 17 participants (28% of total), the attitude *luminous-dark* by 16 participants (27% of total), the attitude *mature-immature* by 15 participants (25% of total). Next, the attitudes *charming-charmless*, *alive-inanimate* and *attractive-repulsive* were mentioned by 14 participants each (23% of total). The attitudes *clean-dirty*, *cheerful-sad* and *soothing-disturbing* were mentioned by 12 participants each (20% of total). While the attitude *cheering-gloomy* was mentioned by 11 participants (18% of total), the attitudes *vivid-pale* and *hard-soft* were mentioned by 10 participants each (17% of total). The attitudes *heavy-light*, *positive-negative*, *active-passive* and *optimistic-pessimistic* were mentioned by 9 participants each (15% of total). The attitudes *entertaining-boring*, *masculine-feminine* and *familiar-unfamiliar* were mentioned by 8 participants each (13% of total). The attitudes *common-rare*, *refreshing-suffocating*, *modern-traditional* and *frivolous-solemn* were mentioned by 7 participants each (12% of total). The attitudes *strong-weak*, *exciting-calming*, *restful-restless*, *expressive-unexpressive*, *pure-impure*, *sincere-insincere* and *aggressive-calm* were mentioned by 6 participants each (10% of total). The attitudes *innocent-malicious*, *clear-complex*, *extraordinary-ordinary* and *beautiful-ugly* were mentioned by five out of 60 participants each (8% of total). The graphical representation of the elicited common bipolar attitudes which were mentioned by 5 and more participants is displayed in Figure 5.2.

Up to this point, the frequency distributions designated that 42 out of 102 common attitudes were mentioned by five and more participants. These 42 common bipolar attitudes indicated 81.8% of the full gathered list. The bottom of the full list, on the other hand, showed the attitudes which were mentioned less than five times by the participants. Five attitudes were mentioned by four participants each (7% of total), 11 attitudes were mentioned by three participants each (5% of total) and 13 attitudes were mentioned by two participants each (3% of total). The rest of 31 attitudes were the least commonly elicited bipolar attitudes which were mentioned only by one participant each (2% of total) (see Appendix G for the full list of the common elicited bipolar attitudes).

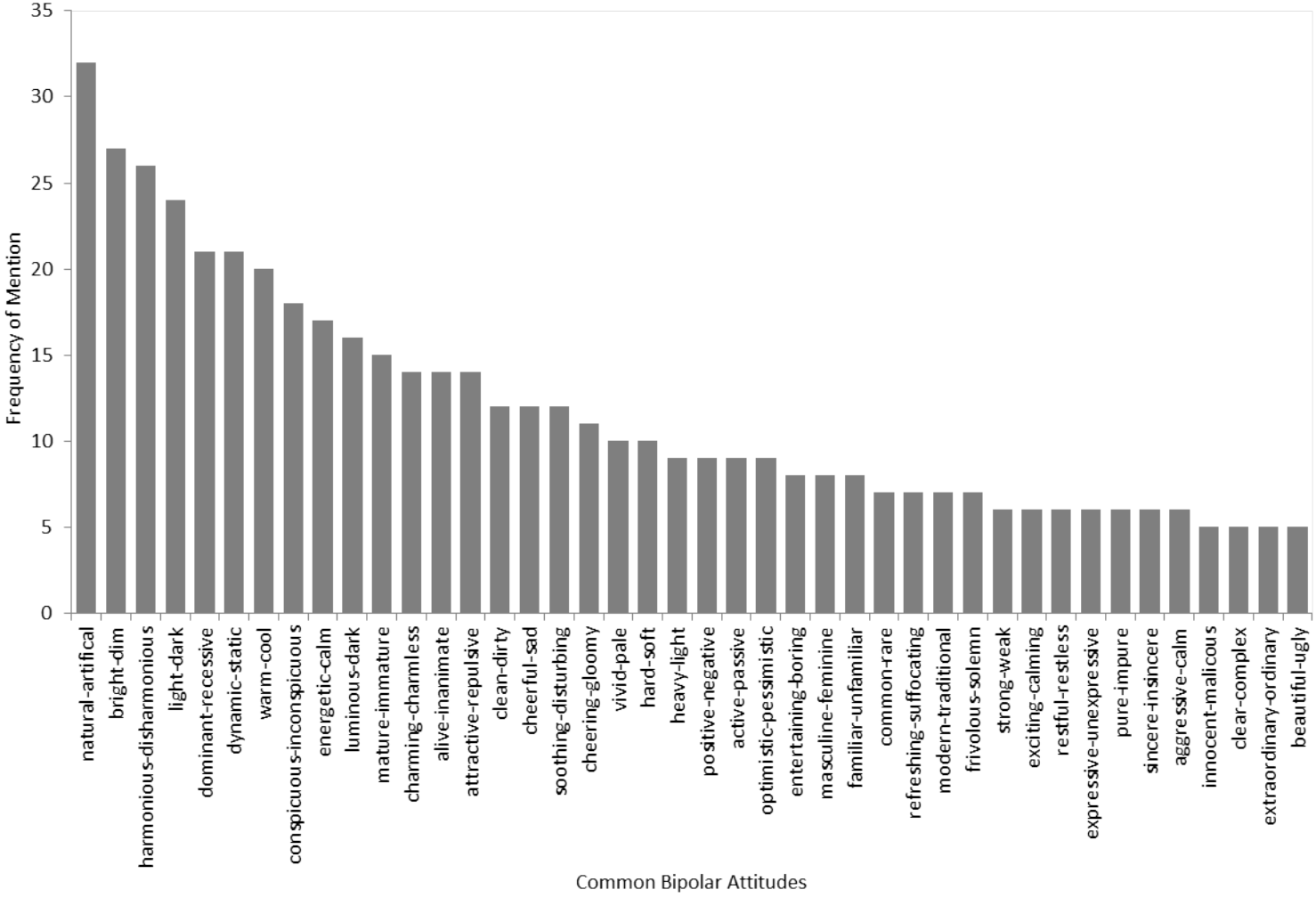


Figure 5.2 The graphical representation of the common bipolar attitudes mentioned by five and more participants

The chi-square goodness of fit test was applied to the data in order to explore whether there were gender differences between the frequency of mentioning of the common elicited attitudes. For the chi-square approximation to be valid, the test is applied when the expected value of the number of sample observations in each level of the variable is at least five (Kalaycı, 2010). Therefore, 42 common attitudes that were mentioned by five and more participants were taken into account. The result of the chi-square goodness of fit test showed that there were no significant differences between the female and male participants in terms of the frequency of mentioning of the common attitudes (chi-square: 10,963, df: 4, $p < 0.05$) (see Appendix H) . However, the female participants elicited significantly more attitudes, i.e. 318 bipolar attitudes, than the male participants, i.e. 288 bipolar attitudes.

Henceforward, the further statistical analyses are done upon 42 common attitudes in order to obtain more reliable and valid results as the suggestion of the goodness of fit test. Before going into examining the patterns and interrelations between the common attitudes and eleven basic colours, the types of the bipolarity and the types of the response attributes of the common elicited attitudes are needed to be described. They are discussed upon the full gathered common attitude list, i.e. 102 of total, in the following subsections.

5.1.4.1 Describing the Bipolarity of the Common Attitudes

Kelly (1955), in his Personal Construct Theory, (see Section 2.6), states that people make sense of their world around them through construing. He states further by saying, each individual makes judgements and interpretations about the events by bringing a particular variety of experience on each new situation. This implicit theoretical framework forms each individual's personal construct system. Individuals use their personal construct systems in order to compare people, things or events around them by eliciting their constructs. Kelly (1955, as cited in Bannister and Fransella, 1986) claims that, individuals' personal construct system are made up of bipolar constructs. The bipolarity exists in the construct itself because it is the way in which individuals make sense of or construe their world by likenesses and differences. In order to explore the structure of individuals' idiosyncratic/personal construction processes, Kelly (1955) developed the RGT as a method by using the idea of bipolarity which makes possible the designing of the grid (Fransella et al., 2004) (see Section 2.6.1).

During the repertory grid interviews of 60 participants, dyadic method of the RGT was utilised to elicit two contrasting poles for each attitude and to obtain ratings of eleven basic colours on each attitude from the participants. Beyond the relationship between the elicited attitudes and eleven basic colours, the common elicited attitudes were concerned whether the participants actually think in bipolar terms while they were construing and giving meaning to eleven basic colours in their own words. To this end, the elicited common attitudes were content analysed according to the semantic and linguistic grounds.

Lyons (1977, as cited in Yorke, 2001) suggests that the bipolar scales in the RGT have a critical importance because of being contrast in nature. Yorke (1983) claims that elicited scales in repertory grids can be in the mixture of logical and peculiar scales, dichotomies and continua, and unipolar and bipolar scales. In accordance, Yorke (2001) classifies three different types of dichotomous contrasts: i. *negation* (i.e. mature-immature), ii. *opposition* (i.e. natural-artificial), and iii. *non-contiguous* (i.e. energetic-calm). Negation and opposition are called as *logical oppositions*, whereas, non-contiguous opposition is called *peculiar opposition* where the opposite poles neither are related with each other nor constitute negation or linguistic opposition (Karapanos and Martens, 2008; Yorke, 2001).

As the result of repertory grid interviews, a total of 102 common attitudes were elicited (see Section 5.1.4). These common attitudes were reviewed according to the above mentioned types of dichotomous contrasts (see Appendix G). Analysis showed that the full common attitude list was composed of all types. It was found that the majority of the common elicited attitudes from the

participants were the opposition attitudes, i.e. 61 out of 102 common attitudes (59.8% of total). On the other hand, 21 out of 102 common attitudes were negation attitudes (20.6% of total) and 20 were non-contiguous attitudes (19.6% of total) (see Figure 5.3).

Although during the repertory grid interviews the logical oppositions were not sought for, as a result of applying opposite method (see Section 4.10.4) to each interview in order to elicit two contrasting poles resulted in obtaining the majority of the elicited attitudes in oppositions. These oppositions were expected as the outcome of the repertory data. The reason for this was the attitudes which were elicited by the opposite method brought the advantages of eliciting both explicit and implicit poles from the participants and obtaining straight attitudes to be rated. In accordance, these attitudes were in the range of convenience to support general conclusions to determine the ways in which the participants construe and give meaning to eleven basic colours.

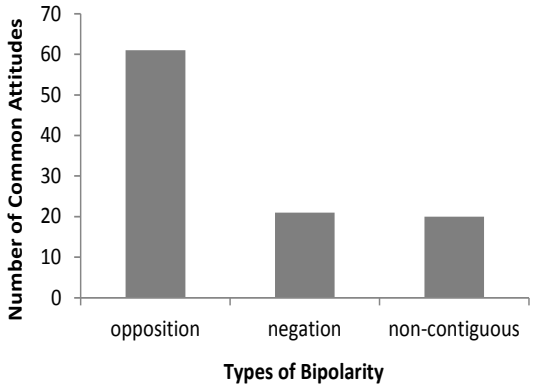


Figure 5.3 The graphical representation of the frequency of common attitude types

Additionally, the types of the elicited dichotomous contrast scales are as follows. The attitude scales which were in oppositions (59.8%) (e.g. *natural-artificial*, *bright-dim*, *light-dark*) were bipolar scales. They had two poles and included increments in two opposite directions. These bipolar scales induced participants to think of the relative proportion of positive versus negative attributes while rating eleven basic colours on a 7-point rating scale. On the other hand, the attitudes scales which were negations (20.6%) (e.g. *harmonious-disharmonious*, *conspicuous-inconspicuous*, *mature-immature*) were unipolar scales. They had one pole and included increments in one direction. These unipolar scales induced participants to think of the presence versus absence of positive characteristics of the attributes. The attitude scales which were non-contiguous (19.6%) (e.g. *energetic-calm*, *refreshing-suffocating*, *modern-traditional*) were bipolar scales, as well. However, they did not constitute oppositions; the bipolarity of these attitudes seemed illogical. They were in the category of peculiar oppositions. Although non-contiguous attitude scales could provide rich information to determine the participants' ways of construing and giving meaning to eleven basic colours, the frequency of mentioning of these scales were not as much as in the opposition attitude scales. Only one non-contiguous attitude scale (i.e. *energetic-calm*) was mentioned by 17 out 60 participants. The other 19 out of 20 non-contiguous attitude scales were mentioned by seven and less participants. Ten of them were mentioned only by one participant each. The reason for this was the peculiarity of these elicited attitudes and they were not collated in any group of the common attitudes (see Section 5.1.3.2). Yorke (1978) states that, all types of constructs or attitudes are used in repertory grid interviews to indicate the underlying dimension of their meaning. However, in this respect, he claims further that the logical constructs or attitudes have a significant superiority to especially the peculiar constructs or attitudes in repertory grids. However, it is important to note that it is likely to increase the number of the participants in the experiment might result in eliciting more non-contiguous attitudes which might be collated in the group of common attitudes.

5.1.4.2 Describing the Response Attributes of the Common Attitudes

Since the purpose of the repertory grid interviews was to determine the ways in which the participants think of, construe and give meaning to perceived colours in their own words, in order to understand how the participants perceive eleven basic colours, their idiosyncratic/personal attitudes were needed to be found out. This was done by dyadic elicitation procedure of the RGT and the procedure result in a list of personal attitudes that the participants used to distinguish between eleven basic colours. During the repertory grid interviews of 60 participants, besides eliciting their personal attitudes, it was wondered which of each elicited personal attitude of the participants was the result of which of the physical and/or psychological response attributes of the colours. In other words, it was wondered whether the participants would verbalise the reasons of their attitudes or responses towards eleven basic colours. To this end, during the repertory grid interviews of each participant, after eliciting his/her each personal attitude with two contrasting poles, he/she was requested to deliver what sort of attribute the colour that he/she was confronted with had. Therefore, four types of category were generated which were i. physical aspects, ii. connotation, iii. meaning, and iv. emotion. The participants were requested to define their elicited attitudes by using one or more categories. The purpose of this was to see whether the elicited personal attitudes grouped under these four categories of response attributes. By doing this, it aimed at finding out which of the elicited attitudes related with the attribute of physical aspects, connotations, meanings or emotions. For this, a total of 102 common attitudes were reviewed and the attitudes were grouped under the four categories (see Appendix G). It is important to note that the elicited attitudes were grouped according to the participants' stated response attributes during their interviews.

The sort of response attributes might result from the physical aspects of the colour itself, i.e. being bright, light or dark and etc., and/or the colour(s) might connote something and/or having some meanings and/or arousing a feeling or emotion. As the result of the analysis, it was found that the majority of the common attitudes were related with the response attribute of emotion i.e. 56 out of 102 common attitudes (54.9% of total). Twenty-seven out 102 (26.5% of total) common attitudes were related with the attribute connotation, 13 (12.7% of total) were related with the attribute physical aspects of the colours and only six out of 102 common attitudes (5.9% of total) were related with the attribute of meaning. Figure 5.4 displays the graphical representation of the frequency of the types of response attributes of the common attitudes.

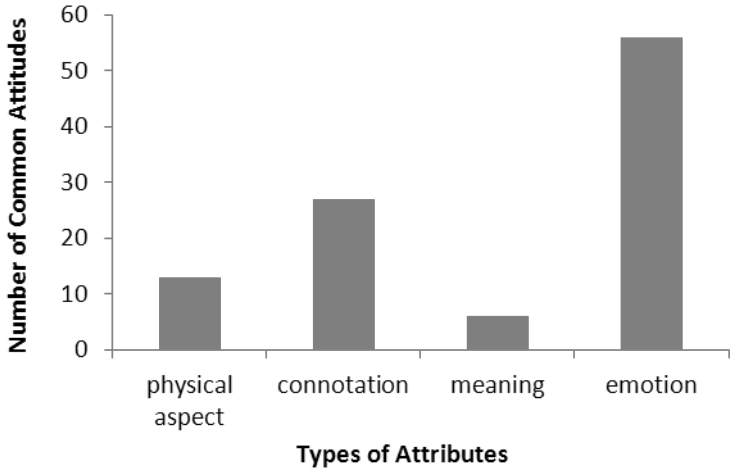


Figure 5.4 The graphical representation of the frequency of attribute types of the common attitudes

5.2 Mean and Standard Deviation of the Repertory Grid Data

Up to this point, the analyses of the elicited repertory grid data were qualitative rather than quantitative. The shared number of elements which were eleven basic colours and shared rating system which were a scale running from 1 to 7 in the repertory grid interviews provided to apply statistical methods in order to search for the patterns in the numerical data. Therefore, the distribution statistics were utilised in order to make some observations about the repertory grid data. The distribution statistics compose of two main components, i.e. *mean* and *standard deviation*. The mean statistics deal with the measures of location in order to give sense of the typical score of the data set, whereas the standard deviation statistics deal with the measures of variability in the data (Larson-Hall, 2010). In other words, in the repertory grid data of this research, the mean statistics showed where each colour was located on average across the elicited attitudes, the standard deviation showed how each colour varied across the elicited attitudes (Bell, 1997/1995).

From 60 repertory grid interviews, as has already been stated, a total of 606 bipolar attitudes were elicited (see Section 5.1.2). In order for the common attitudes to be explored, these bipolar attitudes were collated by grouping the words that had precise meaning like synonyms or the words that shared similar connotations in referring to the same attitude together. Each group then was given a new attitude label according to the meaning underlying the elicited attitudes in that group and different attitudes which had similar connotations of that group were converted into the same given attitude. Subsequently, a total of 102 common attitudes were obtained (see Section 5.1.3.2). The result was the table of common attitudes where each group of the attitudes was identical across the frequency of mentioning of the participants with just the ratings of eleven basic colours being different. In this sense, the average (mean) ratings of eleven basic colours in each cell of the grid of the participant across the frequency of mentioning of the common attitudes were calculated. By doing this, 60 different repertory grids were turned into one single repertory grid table. Each row consisted of each common attitude and each column represented the average rating of each basic colour of that common attitude. As the suggestions of the goodness of fit test (see Section 5.1.4), 42 common attitudes which were mentioned by five and more participants were taken into account and listed in Table 5.4. The purpose was to analyse the patterns and variability in the ratings of eleven basic colours across the common attitudes. It is important to note that the statistical analyses were done upon this single repertory grid. In addition, henceforward, the term *common attitudes* is considered as *the attitudes* and the term *average ratings* is considered as *the ratings* of eleven basic colours.

In order to make some observations about the ways in which the attitudes were used, the mean and the standard deviation of each attitude across eleven basic colours were calculated (see Table 5.5). Since eleven basic colours were located on the attitudes by ratings between 1 (left pole) and 7 (right pole), the midpoint was 4. As indicated by Table 5.5, all means of the attitudes across eleven basic colours are relatively close to the midpoint of the rating scale. This suggests that no attitudes are lopsided which means one pole of the attitude is not used considerably more than the other pole of the attitude (Fransella et al., 2004). In Table 5.5 (highlighted), the standard deviation of the attitudes shows that eleven basic colours are most widely dispersed on the attitudes *frivolous-solemn* (SD: 1.94), *mature-immature* (SD: 1.92), and *alive-inanimate* (SD: 1.89) because of having high values. This means that eleven basic colours are defined with these attitudes more explicitly than the other attitudes by the participants. Moreover, having high standard deviation means eleven basic colours were rated more with the extreme values, i.e. '1' and '7' end of the scales, of these attitudes. On the other hand, eleven basic colours are least dispersed on the attitudes *sincere-insincere* (SD: 0.75) and *modern-traditional* (SD: 0.99) which means the participants did not make a distinct decision on which of the contrasting poles of these attitudes were much more related with eleven basic colours.

Table 5.4 The list of 42 common attitudes with the average ratings of eleven basic colours and their mean and standard deviation statistics

	Average Ratings of Eleven Basic Colours												
	Black	Grey	White	Yellow	Orange	Red	Pink	Purple	Brown	Blue	Green		
List of 42 Common Attitudes	**C1**	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**	**C9**	**C10**	**C11**	**Mean**	**Std. Dev.**
frivolous-solemn	6.9	6.0	5.1	2.1	1.3	4.3	2.0	3.6	5.9	4.6	1.7	3.95	1.94
mature-immature	1.2	2.3	4.5	6.2	6.7	3.6	6.9	4.1	2.4	4.7	6.0	4.42	1.92
alive-inanimate	6.2	6.6	4.7	1.9	1.5	2.1	4.9	4.9	5.5	3.6	1.6	3.95	1.89
cheering-gloomy	6.6	5.8	2.3	1.5	1.9	3.3	3.3	5.2	6.0	3.9	2.4	3.83	1.81
heavy-light	1.0	4.4	6.7	5.1	4.1	2.4	6.1	2.7	1.7	4.4	4.7	3.94	1.80
cheerful-sad	6.4	5.8	3.8	1.3	1.7	3.0	3.5	5.6	5.7	4.3	2.2	3.93	1.78
light-dark	7.0	3.9	1.0	2.3	3.7	4.9	2.3	5.4	5.9	4.7	3.1	4.02	1.75
active-passive	6.0	6.0	4.9	2.1	1.7	1.8	4.6	4.3	6.2	3.8	2.4	3.98	1.75
masculine-feminine	1.5	2.8	5.8	5.0	5.0	6.5	6.6	5.3	2.9	2.6	4.4	4.39	1.71
energetic-calm	5.4	5.8	4.8	1.6	1.5	1.9	4.8	4.3	5.6	5.1	2.5	3.94	1.69
dynamic-static	6.3	6.3	4.4	1.8	1.9	1.9	4.3	4.6	5.5	4.4	2.9	4.03	1.69
refreshing-suffocating	6.4	4.9	1.4	2.0	3.3	4.7	2.9	5.6	5.7	3.1	2.6	3.87	1.66
bright-dim	5.3	6.1	2.7	1.8	2.0	2.7	4.8	4.7	6.2	3.7	2.3	3.83	1.65
exciting-calming	6.0	5.7	5.3	1.8	1.7	1.8	4.7	4.2	5.3	4.3	3.0	3.98	1.64
innocent-malicious	6.4	4.0	1.0	2.4	2.2	4.0	1.2	4.2	4.8	2.8	2.8	3.25	1.61
luminous-dark	6.8	4.5	1.2	2.5	3.3	4.1	2.5	5.1	5.8	4.1	3.4	3.93	1.60
positive-negative	6.0	5.3	2.3	2.1	2.3	4.0	2.8	5.1	5.9	2.9	2.2	3.73	1.57
warm-cool	5.0	5.8	5.0	2.2	1.8	1.3	3.5	4.4	4.4	5.7	4.6	3.95	1.56
clear-complex	4.2	3.0	1.2	2.4	3.8	4.8	2.6	6.0	6.2	3.8	3.4	3.76	1.51
clean-dirty	5.2	5.6	1.0	2.7	2.8	4.0	2.6	5.0	5.8	3.3	3.5	3.77	1.51
entertaining-boring	5.3	5.4	4.4	2.9	1.6	2.3	4.0	3.4	6.8	3.5	3.0	3.85	1.50
pure-impure	5.8	4.8	1.3	3.8	4.5	5.3	3.3	5.3	5.3	2.5	2.3	4.05	1.49
hard-soft	1.1	4.5	5.6	3.9	3.6	2.3	6.5	3.9	3.1	3.7	4.1	3.85	1.46
aggressive-calm	3.8	5.3	6.2	4.0	3.3	1.3	5.7	4.8	6.0	5.7	5.2	4.67	1.44
vivid-pale	4.2	5.7	4.2	2.2	1.6	1.3	4.3	3.7	5.1	3.5	2.4	3.47	1.43
conspicuous-inconspicuous	4.3	6.3	4.2	2.4	2.3	1.8	4.9	4.2	5.2	3.4	2.6	3.77	1.42
optimistic-pessimistic	5.7	5.6	2.3	1.9	2.8	3.4	2.6	4.1	5.1	3.2	2.1	3.53	1.39
dominant-recessive	2.5	6.0	4.2	2.6	2.3	1.5	4.8	3.2	5.2	4.0	3.2	3.58	1.39
expressive-unexpressive	3.0	5.8	3.0	3.7	2.8	1.5	4.2	4.7	5.7	2.8	2.5	3.61	1.35
common-rare	2.1	2.4	2.9	4.1	5.3	4.3	5.1	5.4	1.9	2.3	3.7	3.60	1.35
restful-restless	5.7	3.8	1.8	3.7	4.0	5.7	2.3	4.5	4.0	2.3	2.8	3.70	1.29
strong-weak	1.2	5.2	3.8	3.2	4.0	1.7	5.2	4.2	3.5	3.5	3.0	3.48	1.25
familiar-unfamiliar	3.3	3.1	2.1	4.0	4.0	3.5	5.4	5.4	1.6	2.3	4.0	3.51	1.22
soothing-disturbing	3.1	2.7	3.0	5.8	5.3	5.5	2.9	4.1	3.3	2.5	4.5	3.88	1.21
extraordinary-ordinary	4.6	6.2	5.4	4.0	3.4	4.2	4.4	2.6	6.2	4.6	3.0	4.42	1.18
harmonious-disharmonious	2.5	2.3	2.1	5.3	4.7	4.2	4.9	4.8	4.1	3.5	4.7	3.90	1.13
charming-charmless	4.9	5.1	3.9	2.3	2.1	2.3	3.1	4.2	4.9	4.0	3.1	3.64	1.11
natural-artificial	4.5	5.1	3.4	2.7	3.8	3.4	4.8	5.2	2.3	2.5	2.5	3.66	1.11
beautiful-ugly	3.2	3.8	3.2	3.8	3.4	2.8	5.4	3.8	6.4	3.4	3.0	3.84	1.09
attractive-repulsive	3.4	5.0	3.1	3.9	3.2	2.0	4.6	3.5	5.8	4.4	3.4	3.86	1.04
modern-traditional	3.1	2.7	3.6	4.6	3.3	4.6	5.0	3.9	6.0	4.0	3.0	3.97	0.99
sincere-insincere	5.2	4.8	2.8	4.0	4.2	3.8	4.3	4.5	4.7	3.2	3.2	4.06	0.75

In order to make some observations about the ratings of eleven basic colours on the attitudes *frivolous-solemn*, *mature-immature* and *alive-inanimate*, the distribution statistics of each attitude were calculated. According to the descriptive statistics of the attitude *frivolous-solemn* in Table 5.5 (highlighted), the standard deviation of eleven basic colours show that *red* (SD: 1.60) is the most widely dispersed basic colour on the attitude *frivolous-solemn*. This means that *red* was rated with more extreme values on this attitude than the other basic colours. On the other hand, *black* (SD: 0.38) and *orange* (SD: 0.49) are the least dispersed basic colours on the attitude *frivolous-solemn*. The mean statistics and the minimum and maximum values of these colours show that, *black* (M: 6.86) was rated more substantially by using the right pole (i.e. *solemn*) more than the left pole (i.e. *frivolous*) of the attitude, while *orange* (M: 1.29) was rated more considerably by using the left pole (i.e. *frivolous*) more than the right pole (i.e. *solemn*) of the attitude.

Table 5.5 The descriptive statistics of the attitude *frivolous-solemn*

Descriptive Statistics of the attitude *frivolous-solemn*

Eleven Basic Colours	N	Min.	Max.	Mean	Std. Dev.
Black	7	6.0	7.0	6.86	0.38
Grey	7	4.0	7.0	6.00	1.15
White	7	4.0	7.0	5.14	1.46
Yellow	7	1.0	3.0	2.14	0.69
Orange	7	1.0	2.0	1.29	0.49
Red	7	2.0	7.0	4.29	1.60
Pink	7	1.0	3.0	2.00	0.82
Purple	7	3.0	5.0	3.57	0.79
Brown	7	4.0	7.0	5.86	0.90
Blue	7	3.0	6.0	4.57	1.13
Green	7	1.0	3.0	1.71	0.76
Valid N (listwise)	7				

According to the descriptive statistics of the attitude *mature-immature* in Table 5.6 (highlighted), the standard deviation of eleven basic colours show that *white* is the most widely dispersed basic colour on the attitude *mature-immature*. As it is seen, its mean value (M: 4.00) is at the midpoint and the minimum and maximum values are the two extreme scores selected by the participants. This indicates that the participants rated *white* on the attitude *mature-immature* by selecting from the most extreme ends of the scale. Whereas, *black* (SD: 0.26) is the least dispersed basic colour on the attitude *mature-immature*. The mean statistics and the minimum and maximum values of *black* show that, it (M: 1.07) was rated more considerably by using the left pole (i.e. *mature*) more than the right pole (i.e. *immature*) of the attitude.

Table 5.6 The descriptive statistics of the attitude *mature-immature*

Descriptive Statistics of the attitude *mature-immature*

Eleven Basic Colours	N	Min.	Max.	Mean	Std. Dev.
Black	15	1.0	2.0	1.07	0.26
Grey	15	1.0	4.0	2.13	0.99
White	15	1.0	7.0	4.00	1.89
Yellow	15	3.0	7.0	5.80	1.32
Orange	15	4.0	7.0	6.20	0.94
Red	15	1.0	6.0	3.53	1.77
Pink	15	3.0	7.0	6.47	1.06
Purple	15	1.0	6.0	3.73	1.39
Brown	15	1.0	4.0	2.20	1.01
Blue	15	3.0	7.0	4.33	1.05
Green	15	2.0	7.0	5.60	1.40
Valid N (listwise)	15				

According to the descriptive statistics of the attitude *alive-inanimate* in Table 5.7 (highlighted), the standard deviation of eleven basic colours show that *white* (SD: 2.16) and *pink* (SD: 1.90) are the most widely dispersed basic colours on the attitude *alive-inanimate*. The minimum and maximum values show that, the participants rated *white* and *pink* on this attitude by selecting from the most extreme ends of the scale. Whereas *grey* (SD: 0.65), *green* (0.74) and *orange* (SD: 0.76) are the least dispersed basic colours on the attitude *alive-inanimate*. The mean statistics and the minimum and maximum values of these basic colours show that, *grey* (M: 6.57) was rated more substantially by using the right pole (i.e. *inanimate*) more than the left pole (i.e. *alive*) of the attitude, while *orange* (M: 1.50) and *green* (M: 1.64) were rated more considerably by using the left pole (i.e. *alive*) more than the right pole (i.e. *inanimate*) of the attitude.

Table 5.7 The descriptive statistics of the attitude *alive-inanimate*

Descriptive Statistics of the attitude *alive-inanimate*

Eleven Basic Colours	N	Min.	Max.	Mean	Std. Dev.
Black	14	3.0	7.0	6.21	1.19
Grey	14	5.0	7.0	6.57	0.65
White	14	1.0	7.0	4.71	2.16
Yellow	14	1.0	5.0	1.86	1.23
Orange	14	1.0	3.0	1.50	0.76
Red	14	1.0	5.0	2.14	1.29
Pink	14	1.0	7.0	4.93	1.90
Purple	14	2.0	7.0	4.86	1.61
Brown	14	2.0	7.0	5.50	1.40
Blue	14	1.0	7.0	3.57	1.70
Green	14	1.0	3.0	1.64	0.74
Valid N (listwise)	14				

By using the distribution statistics, it is possible to make the observations about the ways in which all the attitudes are used and in which eleven basic colours are rated on these attitudes. However, in order for the exact descriptions of the interrelations between the attitudes and eleven basic colours to be investigated, the multivariate statistical analysis methods are needed to apply to the repertory grid data. The analysis procedures and the results are discussed in Chapter 6. Before going further, it is necessary to measure the reliability of the repertory grid data in order to see to what extend the elicited data is consistent.

5.3 Reliability Analysis of the Repertory Grid Data

The word *reliability* is the synonym of the word *consistency*. It is a measurement instrument which is used to find the answer to the question: "To what extent […] that the data are consistent?" by the researchers (Huck, 2004, p. 76). Therefore, reliability is for testing the consistency of the data (Ho, 2006). In order to measure the degree to which the data are reliable, different statistical procedures have been developed by the researchers for this purpose. These procedures are divided into two categories; i. external consistency procedures and ii. internal consistency procedures (Huck, 2004; Ho, 2006).

Ho (2006, p. 239) states that "External consistency procedures utilise cumulative test results against themselves as a means of verifying the reliability of the measure." In other words, external consistency reliability focuses on the stability of the data across time and/or equivalence across forms (Huck, 2004). On the other hand, internal consistency procedures refer to the extent to which a measure is consistent within itself. Internal consistency reliability focuses on examining the internal consistency of the test which is applied to a single group of individuals in a single time (Huck, 2004; Ho, 2006). One of the most popular and widely used procedures for examining the internal consistency reliability of the data is *Cronbach's Alpha* or *coefficient alpha*, or simply as *alpha*. This is a single correlation coefficient which its calculation is based on the number of items and the average inter-item correlation. Cronbach's alpha range from 0.00 to +1.00, when alpha (i.e. α) is 0.80 or higher this suggests that all of the items in the data are highly reliable and the test which is applied is internally consistent (Hinton et al., 2004; Ho, 2006).

Jankowicz (2004) claims that after conducting a content analysis to the repertory grid data, the reliability of the data should be checked in order to prevent the idiosyncrasy of the data. Therefore, in this research, Cronbach's Alpha is used as a procedure to assess the internal consistency reliability of the repertory grid data. The repertory grid data was assessed by using 42 attitudes, each with a seven-point rating scale running from 1 to 7. Table 5.9 displays the result of the reliability analysis.

Table 5.8 Reliability statistics of 42 attitudes

Reliability Statistics

Cronbach's Alpha	N of Items
.918	42

As investigated by Table 5.9, Cronbach's Alpha is 0.92, which indicates that 42 attitudes in the data are reliable and the test is internally consistent. Although the result provides a reliable quantitative data, it should be considered that the attitudes that were elicited during the repertory grid interviews were unique and different for each participant. These 42 attitudes were the shared attitudes and their interpersonal repetitions were different. However, eleven basic colours that were utilised for the attitude elicitations and the seven-point rating scale that was used to rate each basic colour on each attitude were the same for each participant.

CHAPTER 6

ANALYSIS PROCEDURES AND RESULTS OF THE STRUCTURE AND INTERRELATIONS BETWEEN THE ELICITED ATTITUDES OF INDIVIDUALS AND THE PERCEIVED COLOURS

The purpose of this chapter is based on finding an answer to the question: How are individuals' attitudes and the perceived colours related? As the second step of this research intended to explore the structure and interrelations between the elicited attitudes of participants and eleven basic colours, the objectives of the analyses include,

- to explore the underlying factors of the common attitudes and their relatedness among eleven basic colours; and
- to investigate the relationship between the common attitudes and eleven basic colours.

In the previous chapter, 60 repertory grids which were obtained as the result of experiment were analysed qualitatively with the utilisation of content analysis procedure. As the result of analysis, 42 common attitudes in a single grid with average ratings of each basic colour were obtained and decided to be used as main data set. In order to explore the above mentioned objectives, this chapter, consequently, is based on analysing the resulted data quantitatively with the utilisation of the multivariate statistical analysis methods which are exploratory factor analysis, bivariate correlation, hierarchical cluster analysis and one sample t-test. These analyses are done by using the SPSS[58] software version 17. Table 6.1 displays the objectives of the research and their statistical analysis methods.

Table 6.1 Research objectives and their statistical analysis methods

Research Objectives	Statistical Analysis Methods
Exploration of the underlying factors of the elicited attitudes and their relatedness among eleven basic colours	Exploratory Factor Analysis One Sample T-Test
Investigation of the relationship between the elicited attitudes and eleven basic colours	Bivariate Correlation Hierarchical Cluster Analysis One Sample T-Test

[58] SPSS is the abbreviation of Statistical Package for the Social Sciences. It is a computer program used for statistical analysis. SPSS is the most widely used program in behavioural and social sciences (Larson-Hall, 2010).

6.1 Exploration of the Underlying Factors of the Common Attitudes

As the result of the content analysis of each repertory grid that was elicited from 60 repertory grid interviews, a total of 102 common attitudes were obtained. The list of common attitudes was compiled by calculating the average ratings of each basic colour according to the interpersonal repetitions of each attitude. By doing this, 60 different repertory grids were turned into a single repertory grid table. In this table, each row comprised of each common attitude and each column consisted of the average ratings of each basic colour of that corresponding common attitude. Thus the resulted single data was the table of cases (i.e. eleven basic colours) by variables (i.e. common attitudes) data matrix with the ratings arranged in rows and columns into that table. This data was a 102 x 11 grid which contained 1246 pieces of information to be analysed (see Section 5.1.1.2). In order to reduce the information to be analysed, the suggestion of the goodness of fit test was taken into consideration. The test offers that in order to get reliable and valid results from the data, the number of observations in each level of the variable should be at least five. Therefore, a decision was taken that the common attitudes which were mentioned by five and more participants carried more reliable (see Section 5.3) in understanding the ways in which the participants construe and give meaning to eleven basic colours than less frequently mentioned attitudes. This referred to 42 common attitudes which indicated 82% of the full gathered common attitude list in terms of the interpersonal repetitions of the attitudes. This repertory grid table which included 42 common attitudes and the average ratings of each basic colour is considered as the main data set in order for the multivariate statistical analysis methods to be conducted. Although the data set was reduced into 42 attitudes, this new data included a great variety of information, as well, i.e. 42 x 11 grid which contained 526 pieces of information to be analysed. Analysing this amount of information one by one required a great of time. Subsequently, the data was reduced again by conducting an exploratory factor analysis in order to determine the major factors or dimensions underlying the attitudes towards eleven basic colours. The details and results are discussed in the following.

6.1.1 Exploratory Factor Analysis of the Repertory Grid Data

Exploratory factor analysis (hereinafter EFA) was conducted in order to group the quantitative variables, i.e. 42 attitudes, together in the repertory grid data. In this research, an EFA was preferred to use because this was the first study using the RGT in order to determine the ways in which the participants construe and give meaning to eleven basic colours in their own words. Moreover, the study was based on data-driven approaches and on exploring the underlying factors of the elicited attitudes, accordingly. Stern (2010) states that, in order to discover the underlying processes of the study that is done, EFA tends to be used at early stages of the research because most of its application is exploratory in nature. In accordance, Goodwin (1999) claims that, EFA is a technique for reducing a data which helps the researcher to determine the underlying structure of a set of variable, or in other words, items on a measure. EFA is often called in short *factor analysis*. Factor analysis was first introduced by Charles Spearman in 1904, since then, it has been one of the most widely used data-analytic techniques in psychology, sociology, education and as well as colour meaning and colour emotion. Its general definition is given by Hair et al.[59] (1995, as qtd. in Goodwin, 1999, p. 89) as follows;

> Factor analysis is a generic name given to a class of multivariate statistical methods whose primary purpose is to define the underlying structure in a data matrix. Broadly speaking, it addresses the problem of analysing the structure of the inter-relationships (correlations) among a large number of variables […] by defining a set of common underlying dimensions, known as factors. With factor analysis, the analyst can first identify the separate dimensions

[59] Hair, J. F, Jr., Anderson, R. E., Tatham, R. L., & Black, W. C. (4th Ed.). (1995). *Multivariate data analysis.* Englewood Cliffs, NJ: Prentice Hall.

of the structure and then determine the extent to which each variable is explained by each dimension.

To summarise, factor analysis is a set of techniques in order to determine the extent to which variables that are related are grouped together. Hence, the grouped variables can be treated as one combined variable or factor instead of treating them as a series of separate variables (Cramer, 2003). In other words, factor analysis is used primarily as a tool for reducing the number of variables. Although there are a number of methods to extract factors from a set of variables, in factor analysis the most widely used method for factor extraction is *principal component analysis*. The term *component* is used as another term for *factor* (Cramer, 2003; Stern, 2010). In this research, the term factor is preferred to be used.

Thompson (2004) states that factor analytical methods have various purposes in the research. He defines these purposes in three categories as follows. First, "[…] factor analysis can be used to develop theory regarding the nature of constructs." (p. 5). This means that the results of factor analysis may be used to specify construct dimensions in various other researches. Second, the results of factor analysis can be used in subsequent statistical analyses, i.e. factors correlation, in order to summarise the relationship between the data set. He claims further that factor analysis is not the final analysis; it is only an intermediate step of the further statistical analyses. Third, factor analysis can be used to measure the validity of the research because "[…] factor analysis nevertheless is helpful in addressing construct validity questions." (p. 5).

The above mentioned purposes of factor analysis are taken into consideration for the analysis of the repertory grid data. In the following, first, factor analysis is applied to the repertory grid data in order to classify 42 attitudes and specify the dimensions of the attitudes. In accordance with the results of the factor analysis the validity of the data is discussed. Second, in order to explore the relationships among the specified dimensions of the attitudes, factors correlation of the data is calculated.

6.1.1.1 Results of Factor Analysis

The main purpose of applying factor analysis is to reduce the data set from a group of 42 interrelated attitudes into a small set of attitudes and to identify meaningful dimensions. Thus, factor analysis with principal components extraction, followed by varimax rotation[60] was employed to investigate the factor structure of these 42 attitudes. In Table 6.2, the Total Variance Explained output of the factor analysis presents the number of common factors extracted, the eigenvalues[61] associated with these factors, the percentage of total variance accounted for by each factor, and the cumulative percentage of total variance accounted for by the factors. Using the criterion of retaining only factors with eigenvalues of 1.00 or greater, six factors were retained for rotation. Components with eigenvalues less than 1.00 are removed from the table of the total variance explained output.

[60] Varimax rotation is one of the orthogonal rotation methods of factor analysis. Orthogonal rotation accepts the factors are independent and uncorrelated. The most commonly used method of orthogonal rotation is varimax. Its goal is to give the clearest separation of factors by making high loadings higher and low ones lower for each factor (Ho, 2006; Tabachnick and Fidell, 1996).

[61] An eigenvalue is a ratio between the common and the unique variance which is explained by a specific factor. In factor analysis, only factors with eigenvalues of 1.00 or greater to be significant which indicates that more common variance than unique variance is explained by that factor (Ho, 2006).

Table 6.2 The Total Variance Explained output (first run with 42 attitudes)

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	20.975	49.940	49.940	20.975	49.940	49.940	15.631	37.217	37.217
2	10.084	24.009	73.949	10.084	24.009	73.949	13.037	31.041	68.258
3	4.309	10.259	84.209	4.309	10.259	84.209	4.382	10.434	78.692
4	2.869	6.832	91.041	2.869	6.832	91.041	3.851	9.168	87.860
5	1.485	3.536	94.576	1.485	3.536	94.576	2.290	5.453	93.313
6	1.047	2.492	97.068	1.047	2.492	97.068	1.577	3.756	97.068

Extraction method: principal component analysis.

These six factors accounted for 49.94%, 24.01%, 10.26%, 6.83%, 3.54%, and 2.49% of total variance, respectively, for a total of 97.07%. The Rotated Component Matrix (see Appendix I) presents the six factors after varimax rotation. The rotated factor structure shows that one attitude which is *masculine-feminine* significantly cross-loaded across Factor 2 and Factor 4. Büyüköztürk (2002) claims that, the differences between the cross-loaded items in the rotated factor structure should be at least 0.10. Therefore, the attitude *masculine-feminine* was deleted because the deletion of cross-loaded item clarifies the factors and makes their interpretation easier (Ho, 2006). Although six factors for the first run of factor analysis seem to be extracted, no item loadings exist in the sixth factor. Therefore, the repertory grid data with 41 attitudes was run again for five factor solutions.

Table 6.3 presents the Total Variance Explained output of the five factors solutions with 41 attitudes. These five factors accounted for 49.94%, 24.01%, 10.26%, 6.83%, and 3.54% of total variance, respectively, for a total of 94.58%. The Rotated Component Matrix (see Appendix J) presents the five factors after varimax rotation. The rotated factor structure shows that no cross-loaded items exist. Although five factors for the second run of factor analysis seem to be extracted, no item loadings exist in the fifth factor. Therefore, the repertory grid data with 41 attitudes was run again for four factor solutions.

Table 6.3 The Total Variance Explained output (second run with 41 attitudes)

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	20.975	49.940	49.940	20,975	49.940	49.940	17.112	40.744	40.744
2	10.084	24.009	73.949	10,084	24.009	73.949	13.179	31.378	72.121
3	4.309	10.259	84.209	4,309	10.259	84.209	3.956	9.418	81.540
4	2.869	6.832	91.041	2,869	6.832	91.041	3.861	9.192	90.732
5	1.485	3.536	94.576	1,485	3.536	94.576	1.615	3.844	94.576

Extraction method: principal component analysis.

Table 6.4 presents the Total Variance Explained output of the four factors solutions with 41 attitudes. These four factors accounted for 49.98%, 24.55%, 10.20%, and 6.96% of total variance, respectively, for a total of 91.69%.

Table 6.4 The Total Variance Explained output (third run with 41 attitudes)

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	20.493	49.982	49.982	20.493	49.982	49.982	16.889	41.192	41.192
2	10.066	24.552	74.534	10.066	24.552	74.534	13.037	31.799	72.990
3	4.182	10.200	84.734	4.182	10.200	84.734	4.103	10.007	82.997
4	2.852	6.956	91.690	2.852	6.956	91.690	3.564	8.693	91.690

Extraction method: principal component analysis.

The Rotated Component Matrix of four factor solutions in Table 6.5 presents the loadings of 41 attitudes on four factors after varimax rotation. The rotated factor structure shows that no cross-loaded items exist. For interpretation purposes, only the attitudes with loadings of 0.40 and above are considered because when the loading is greater, the variable has a pure measure of the factor (Tabachnick and Fidell, 1996). Thus, the attitudes with the loadings of magnitude lower than 0.40 are ignored and the attitudes with the loadings 0.50 and above are considered substantial. In the matrix, the horizontal dotted lines are used to show the borders between the factors. Factor 1 contains 19 attitudes, 17 of them loaded positively and 2 of them loaded negatively on that factor. Factor 2 contains 15 attitudes, 12 of them loaded positively and 3 of them loaded negatively on that factor. Factor 3 contains three attitudes; all of them loaded positively on that factor and Factor 4 contains four attitudes; all of them loaded positively on that factor, as well. In order to interpret these extracted four factors, each factor is characterised by assigning it a name or label according to the underlying dimensions that unifies the group of variables loading on it. The assigned labels for each factor are as in the following.

Factor 1 is characterised by the attitude scales with high loadings: *exciting-calming*, *vivid-pale, energetic-calm*, *dynamic-static*, *active-passive*, *conspicuous-inconspicuous*, *soothing-disturbing*, *alive-inanimate* and *charming-charmless*. They are thought of as indicating that this is a type of ***activity*** factor which explains the largest proportion of the overall variance (49.98% of a variance).

Factor 2 is characterised by the attitude scales with high loadings: *heavy-light*, *refreshing-suffocating*, *innocent-malicious*, *light-dark*, *pure-impure*, *luminous-dark*, and *restful-restless*. They are thought of as indicating that this is a type of ***lightness-purity*** factor which explains the next largest proportion of variance that is not explained by the first factor (24.55% of a variance).

Factor 3 is clearly labelled as ***evaluation*** factor, as shown by the high loadings of the attitude scales *beautiful-ugly* and *modern-traditional* which explains the third proportion of variance (10.20% of a variance).

Factor 4 is characterised by the attitude scales with high loadings: *familiar-unfamiliar* and *natural-artificial*. They are thought of as indicating that this is a type of ***familiarity*** factor which explains the smallest proportion of variance (6.96% of a variance). Although the attitude scale *strong-weak* seems to be related with the forcefulness or the strength of a colour (Osgood et al., 1957; Wright and Rainwater, 1962) (see Section 2.5.1), it is also grouped under the dimension of *familiarity* with a lowest loading.

Table 6.5 The Rotated Component Matrix of four factor solutions

Rotated Component Matrix[a]

		Component			
		1	2	3	4
Activity	exciting-calming	0.966			
	vivid-pale	0.962			
	energetic-calm	0.956			
	dynamic-static	0.946			
	active-passive	0.937			
	conspicuous-inconspicuous	0.927			
	soothing-disturbing	-0.922			
	alive-inanimate	0.918			
	charming-charmless	0.909			
	warm-cool	0.874			
	entertaining-boring	0.832			
	dominant-recessive	0.814			
	cheerful-sad	0.804			
	bright-dim	0.785			
	harmonious-disharmonious	-0.741			
	frivolous-solemn	0.710			
	aggressive-calm	0.700			
	extraordinary-ordinary	0.677			
	expressive-unexpressive	0.621			
Lightness-Purity	heavy-light		-0.976		
	refreshing-suffocating		0.944		
	innocent-malicious		0.943		
	light-dark		0.936		
	pure-impure		0.928		
	luminous-dark		0.925		
	restful-restless		0.911		
	clean-dirty		0.853		
	positive-negative		0.838		
	hard-soft		-0.834		
	clear-complex		0.813		
	optimistic-pessimistic		0.770		
	sincere-insincere		0.751		
	cheering-gloomy		0.725		
	mature-immature		-0.701		
Evaluation	beautiful-ugly			0.914	
	modern-traditional			0.801	
	attractive-repulsive			0.724	
Familiarity	familiar-unfamiliar				0.873
	natural-artificial				0.835
	common-rare				0.712
	strong-weak				0.541

Extraction Method: Principle Component Analysis.

Rotation Method: Varimax with Kaizer Normalisation.

a. Rotation converged in 7 iterations.

While labelling the four factors, Osgood et al.'s (1957), Wright and Rainwater's (1962), Hogg's (1969) and Sivik's (1974a) theories regarding their studies on colour meaning were made use of (see Section 2.5.1). Consequently, this four-factor model appears to reflect adequately the underlying factor structure of 41 attitudes of the participants towards eleven basic colours. In other words, eleven basic colours against 41 attitudes are accounted for in terms of only these four dimensions; *activity*, *lightness-purity*, *evaluation*, and *familiarity*. Goodwin (1999) states that factor analysis is an appropriate statistical approach for assessing the internal structure of a data and is a way of estimating construct validity. She claims further that factor analysis has become a widely used technique in validation research. In order to establish the validity of on these elicited attitudes, the construct validity of data is assessed by using factor analysis. As a result, the four-factor solution of factor analysis provides reasonably valid quantitative data. It is important to note that this four-factor structure does not mean that there are only four dimensions of the attitudes of the participants towards eleven basic colours. It is likely to identify additional factors by using the full gathered data of 102 common attitudes. The following section discusses the correlations among four dimensions of attitudes over eleven basic colours.

6.1.1.2 Relationships among Four Factors of Attitudes

In order to explore the relationships among the four factors of the attitudes over eleven basic colours, their correlation coefficients (symbolised as *r*) were calculated (see Section 6.2.1). Correlation coefficient is reported as a decimal number between -1.00 and +1.00. When *r* is -1.00, this indicates a perfect negative correlation between the measured variables. On the other hand, when *r* is +1.00, this indicates a perfect positive correlation between the measured variables. When *r* equals 0.00, this indicates there are no correlations between the measured variables. For interpretation purposes, the correlation coefficients of ± 0.80 and above are considered (Huck, 2004). Table 6.6 presents the relationships among the four factors of the attitudes over eleven basic colours in a correlation matrix.

Table 6.6 The relationships among four factors of the attitudes over eleven basic colours

Correlations

		Factor			
Factor		**Activity**	**Lightness-Purity**	**Evaluation**	**Familiarity**
Activity	Pearson Correlation	1.00	0.513	0.495	-0.154
	Sig. (2-tailed)		0.107	0.121	0.651
	N	11	11	11	11
Lightness-Purity	Pearson Correlation	0.513	1.00	0.269	-0.020
	Sig. (2-tailed)	0.107		0.424	0.954
	N	11	11	11	11
Evaluation	Pearson Correlation	0.495	0.269	1.00	-0.049
	Sig. (2-tailed)	0.121	0.424		0.887
	N	11	11	11	11
Familiarity	Pearson Correlation	-0.154	-0.020	-0.049	1.00
	Sig. (2-tailed)	0.651	0.954	0.887	
	N	11	11	11	11

As indicated by Table 6.6, there are moderate relationships among *activity* factor (*r*= 1.00) and *lightness-purity* factor (*r*= 0.51). Moreover, there are also moderate relationships among *activity* factor (*r*= 1.00) and *evaluation* factor (r= 0.51). As shown, there are no correlations among the other factors. It can be concluded in essence that, the attitudes within the factors are not associated with each other, in other words, they are well dissociated among the factors. Further statistical analyses, henceforward, are done within these four factors.

6.2 Investigation of the Relationships between the Common Attitudes and Eleven Basic Colours

This single repertory grid data, as has already been stated, contained a great amount of information, i.e. i. the relationship amongst the attitudes, ii. the relationship amongst eleven basic colours, and iii. the relationship between the attitudes and eleven basic colours. In order to investigate the interrelations between the attitudes and eleven basic colours, the above mentioned information in the repertory grid should be analysed. The purpose was to understand which perceived colours were particularly differentiated by which elicited attitudes of the participants. By doing this, the patterns and relatedness of eleven basic colours can be defined and/or described by the elicited attitudes of the participants. To this end, the analyses were conducted in terms of three steps. First, the relationships among the attitudes within each factor were analysed by using bivariate correlation method. Second, the relationships among eleven basic colours within each factor were analysed by using hierarchical cluster analysis method. Third, the relationships between the attitudes and eleven basic colours within each factor were analysed by using one sample t test method.

6.2.1 Bivariate Correlation: The Relationships among the Common Attitudes within Each Four Factor

Correlation is used to measure the association between the variables. In other words, it is the measure of the size and direction of the relationship between the two variables. The most frequently used bivariate correlation measure is *Pearson's product-moment correlation* which is symbolised with *r* and it is often referred to as *Pearson's correlation* or Pearson *r*. The value of *r* ranges between +1.00 and -1.00, where values close to 0.00 indicate no relationship (see Section 6.1.1.2). The value of *r* is close to either +1.00 or -1.00, this indicates perfect relationship of one score when the other is known. Generally, the value ± 0.80 and above are used to interpret the predictability of the relationship between the variables. When the value of *r* has a positive correlation, this indicates a direct relationship between the measured variables. On the other hand, when the value of *r* has a negative correlation, this indicates an indirect or inverse relationship between the measured variables (Tabachnick and Fidell, 1996; Huck, 2004).

In RGT, the forms of correlations and distances have been used to calculate the association between one construct and another. Fransella et al. (2004) claim that, as a statistical method, conducting a correlation analysis is the best way of interpreting the associations of the constructs. Therefore, the correlations among the attitudes were calculated within each factor, i.e. *activity*, *lightness-purity*, *evaluation*, and *familiarity*. The results are discussed in the following.

6.2.1.1 Results of Correlations among the Common Attitudes within *Activity* Factor

The *activity* factor contains 19 attitudes. Pearson's product-moment correlation of each attitude was calculated. Table 6.7 displays the correlation matrix among 19 attitudes within the *activity* factor. It is important to note that, the negative correlations indicate the left pole of one attitude is associated with the right pole of the other attitude, and vice versa. The correlation matrix in Table 6.7 is interpreted as follows;

- The attitude *exciting-calming* is very closely associated with the attitudes *energetic-calm* (*r*= 0.97), *dynamic-static* (*r*= 0.97) and *active-passive* (*r= 0.97)*. This indicates that eleven basic colours which are seen as *exciting* tend to be seen and construed as *energetic*, *dynamic*, and *active*, as well. Conversely, eleven basic colours which are seen as *calming* are also likely to be perceived as *calm*, *static* and *passive* because of the bipolarity of the attitudes. Besides, the basic colours which are perceived as *exciting* is likely to be seen as *vivid* (*r*= 0.94), *alive* (*r*= 0.94), *charming* (*r*= 0.92), *disturbing* (*r*= -0.91), *conspicuous* (*r*= 0.89), *entertaining* (*r*= 0.87), *cheerful* (*r*= 0.86), *warm* (*r*= 0.84), and *bright* (*r*= 0.81) and vice versa.

- The attitude *vivid-pale* is very closely associated with the attitude *conspicuous-inconspicuous* (*r*= 0.98). This indicates that eleven basic colours which are construed as *vivid* tend to be perceived as *conspicuous*, as well. Whereas, eleven basic colours which are seen as *pale* are also likely to be perceived as *inconspicuous*. Besides, the basic colours which are seen as *vivid* tend to be perceived as *active* (*r*= 0.96), *exciting* (*r*= 0.94), *energetic* (*r*= 0.94), *dynamic* (*r*= 0.93), *alive* (*r*= 0.93), *entertaining* (*r*= 0.90), *charming* (*r*= 0.89), *dominant* (*r*= 0.88), *disturbing* (*r*= -0.86) and *bright* (*r*= 0.86), and vice versa.

- The attitude *energetic-calm* is very closely associated with the attitude *exciting-calming* (*r*= 0.97). This indicates that eleven basic colours which are perceived as *energetic* tend to be seen as *exciting*. Whereas, eleven basic colours which are seen as *calm* are likely to be construed as *calming* because of the bipolarity of the attitudes. Besides, the basic colours which are perceived as *energetic* tend to be perceived as *dynamic* (*r*= 0.96), *active* (*r*= 0.95), *disturbing* (*r*= -0.95), *vivid* (*r*= 0.94), *alive* (*r*= 0.93), *charming* (*r*= 0.92), *conspicuous* (*r*= 0.89), *cheerful* (*r*= 0.88), *bright* (*r*= 0.86), *entertaining* (*r*= 0.85) and *warm* (*r*= 0.84), and vice versa.

- The attitude *dynamic-static* is very closely associated with the attitudes *exciting-calming* (*r*= 0.97), *active-passive* (*r*= 0.97) and *charming-charmless* (*r*= 0.97). This indicates that eleven basic colours which are construed as *dynamic* tend to be perceived as *exciting*, *active* and *charming*. Conversely, eleven basic colours which are seen as *static* are likely to be seen as *calming*, *passive* and *charmless* because of the the bipolarity of the attitudes. Besides, the basic colours which are perceived as *dynamic* tend to be seen as *energetic* (*r*= 0.96), *alive* (*r*= 0.96), *vivid* (*r*= 0.93), *cheerful* (*r*= 0.93), *conspicuous* (*r*= 0.90), *bright* (*r*= 0.90), *disturbing* (*r*= -0.87), *entertaining* (*r*= 0.87) and *warm* (*r*= 0.83), and vice versa.

- The attitude *active-passive* is very closely associated with the attitudes *exciting-calming* (*r*= 0.97), *dynamic-static* (*r*= 0.97) and *alive-inanimate* (*r*= 0.97). This indicates that eleven basic colours which are construed as *active* tend to be perceived as *exciting*, *dynamic* and *alive*. Oppositely, eleven basic colours which are seen as *passive* are likely to be seen as *calming*, *static* and *inanimate* because of the bipolarity of the attitudes. Besides, the basic colours which are perceived as *active* tend to be seen as *vivid* (*r*= 0.96), *energetic* (*r*= 0.95), *entertaining* (*r*= 0.94), *conspicuous* (*r*= 0.93), *charming* (*r*= 0.93), *cheerful* (*r*= 0.89), *bright* (*r*= 0.89) and *disturbing* (*r*= -0.84), and vice versa.

- The attitude *conspicuous-inconspicuous* is very closely associated with the attitude *vivid-pale* (*r*= 0.98). This indicates that eleven basic colours which are construed as *conspicuous* tend to be perceived as *vivid*. Oppositely, eleven basic colours which are seen as *inconspicuous* are likely to be seen as *pale* because of the bipolarity of the attitudes. Besides, the basic colours which are perceived as *conspicuous* tend to be seen as *active* (*r*= 0.93), *alive* (*r*= 0.93), *dynamic* (*r*= 0.90), *exciting* (*r*= 0.89), *energetic* (*r*= 0.89), *dominant* (*r*= 0.88), *bright* (*r*= 0.88), *charming* (*r*= 0.84), *entertaining* (*r*= 0.84), *expressive* (*r*= 0.83) and *disturbing* (*r*= -0.80), and vice versa.

Table 6.7 Correlation matrix among 19 attitudes within *activity* factor

	Attitude																		
Attitude	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**
1. exciting-calming	**1.00**	0.94	**0.97**	**0.97**	**0.97**	0.89	-0.91	0.94	0.92	0.84	0.87	0.70	0.86	0.81	-0.70	0.75	0.65	0.61	0.55
2. vivid-pale	0.94	**1.00**	0.94	0.93	0.96	**0.98**	-0.86	0.93	0.89	0.78	0.90	**0.88**	0.79	0.86	-0.57	0.65	0.72	0.69	0.79
3. energetic-calm	**0.97**	0.94	**1.00**	0.96	0.95	0.89	**-0.95**	0.93	0.92	0.84	0.85	0.76	0.88	0.86	-0.64	0.74	0.67	0.64	0.60
4. dynamic-static	**0.97**	0.93	0.96	**1.00**	**0.97**	0.90	-0.87	0.96	**0.97**	0.83	0.87	0.68	**0.93**	0.90	-0.67	0.78	0.56	0.58	0.62
5. active-passive	**0.97**	0.96	0.95	**0.97**	**1.00**	0.93	-0.84	**0.97**	0.93	0.75	**0.94**	0.72	0.89	0.89	-0.63	0.78	0.60	0.68	0.68
6. conspicuous-inconspicuous	0.89	**0.98**	0.89	0.90	0.93	**1.00**	-0.80	0.93	0.84	0.70	0.84	**0.88**	0.77	0.88	-0.51	0.58	0.66	0.65	**0.83**
7. soothing-disturbing	-0.91	-0.86	-0.95	-0.87	-0.84	-0.80	**1.00**	-0.80	-0.80	**-0.86**	-0.71	-0.76	-0.72	-0.70	0.65	-0.59	-0.73	-0.58	-0.43
8. alive-inanimate	0.94	0.93	0.93	0.96	**0.97**	0.93	-0.80	**1.00**	0.90	0.69	0.85	0.67	0.91	**0.91**	-0.63	0.77	0.48	0.62	0.67
9. charming-charmless	0.92	0.89	0.92	**0.97**	0.93	0.84	-0.80	0.90	**1.00**	0.85	0.88	0.65	**0.93**	0.86	-0.66	0.82	0.56	0.58	0.63
10. warm-cool	0.84	0.78	0.84	0.83	0.75	0.70	-0.86	0.69	0.85	**1.00**	0.65	0.67	0.69	0.58	-0.64	0.57	0.76	0.40	0.42
11. entertaining-boring	0.87	0.90	0.85	0.87	0.94	0.84	-0.71	0.85	0.88	0.65	**1.00**	0.71	0.78	0.84	-0.54	0.76	0.57	0.77	0.69
12. dominant-recessive	0.70	0.88	0.76	0.68	0.72	0.88	-0.76	0.67	0.65	0.67	0.71	**1.00**	0.48	0.67	-0.37	0.34	**0.82**	0.68	0.79
13. cheerful-sad	0.86	0.79	0.88	0.93	0.89	0.77	-0.72	0.91	0.93	0.69	0.78	0.48	**1.00**	0.90	-0.59	**0.84**	0.32	0.47	0.54
14. bright-dim	0.81	0.86	0.86	0.90	0.89	0.88	-0.70	0.91	0.86	0.58	0.84	0.67	0.90	**1.00**	-0.39	0.68	0.39	0.56	0.75
15. harmonious-disharmonious	-0.70	-0.57	-0.64	-0.67	-0.63	-0.51	0.65	-0.63	-0.66	-0.64	-0.54	-0.37	-0.59	-0.39	**1.00**	-0.81	-0.25	-0.65	-0.08
16. frivolous-solemn	0.75	0.65	0.74	0.78	0.78	0.58	-0.59	0.77	0.82	0.57	0.76	0.34	0.84	0.68	**-0.81**	**1.00**	0.15	0.70	0.29
17. aggressive-calm	0.65	0.72	0.67	0.56	0.60	0.66	-0.73	0.48	0.56	0.76	0.57	0.82	0.32	0.39	-0.25	0.15	**1.00**	0.37	0.57
18. extraordinary-ordinary	0.61	0.69	0.64	0.58	0.68	0.65	-0.58	0.62	0.58	0.40	0.77	0.68	0.47	0.56	-0.65	0.70	0.37	**1.00**	0.47
19. expressive-unexpressive	0.55	0.79	0.60	0.62	0.68	0.83	-0.43	0.67	0.63	0.42	0.69	0.79	0.54	0.75	-0.08	0.29	0.57	0.47	**1.00**

- The attitude *soothing-disturbing* is inversely associated with the other attitudes which is very closely, but inversely, associated with the attitude *energetic-calm* (*r*= -0.95). This indicates that eleven basic colours which are construed as *soothing* tend to be perceived as *calm*. On the other hand, eleven basic colours which are seen as *disturbing* are likely to be seen as *energetic*. Besides, the basic colours which are perceived as *soothing* tend to be seen as *calming* (*r*= -0.91), *static* (*r*= -0.87), *pale* (*r*= -0.86), *cool* (*r*= -0.86), *passive* (*r*= -0.84), *inconspicuous* (*r*= -0.80), *inanimate* (*r*= -0.80) and *charmless* (*r*= -0.80), and vice versa.

- The attitude *alive-inanimate* is very closely associated with the attitude *active-passive* (*r*= 0.97). This indicates that eleven basic colours which are construed as *alive* tend to be perceived as *active*. Whereas, eleven basic colours which are seen as *inanimate* are likely to be seen as *passive* because of the bipolarity of the attitudes. Besides, the basic colours which are perceived as *alive* tend to be seen as *dynamic* (*r*= 0.96), *exciting* (*r*= 0.94), *vivid* (*r*= 0.93), *energetic* (*r*= 0.93), *conspicuous* (*r*= 0.93), *cheerful* (*r*= 0.91), *bright* (*r*= 0.91), *charming* (*r*= 0.90), *entertaining* (*r*= 0.85) and *disturbing* (*r*= -0.80), and vice versa.

- The attitude *charming-charmless* is very closely associated with the attitude *dynamic-static* (*r*= 0.97). This indicates that eleven basic colours which are construed as *charming* tend to be perceived as *dynamic*. Whereas, eleven basic colours which are seen to be *charmless* are likely to be seen as *static* because of the bipolarity of the attitudes. Besides, the basic colours which are perceived as *charming* tend to be seen as *active* (*r*= 0.93), *cheerful* (*r*= 0.93), *exciting* (*r*= 0.92), *energetic* (*r*= 0.92), *alive* (*r*= 0.90), *vivid* (*r*= 0.89), *entertaining* (*r*= 0.88), *bright* (*r*= 0.86), *warm* (*r*= 0.85), *conspicuous* (*r*= 0.84), *frivolous* (*r*= 0.82) and *disturbing* (*r*= -0.80), and vice versa.

- The attitude *warm-cool* is closely, but inversely, associated with the attitude *soothing-disturbing* (*r*= -0.86). This indicates that eleven basic colours which are construed as *warm* tend to be perceived as *disturbing*. Whereas, eleven basic colours which are seen as *cool* are likely to be seen as *soothing*. Besides, the basic colours which are perceived as *warm* tend to be seen as *charming* (*r*= 0.85), *exciting* (*r*= 0.84), *energetic* (*r*= 0.84) and *dynamic* (*r*= 0.83), and vice versa.

- The attitude *entertaining-boring* is very closely associated with the attitude *active-passive* (*r*= 0.94). This indicates that eleven basic colours which are construed as *entertaining* tend to be perceived as *active*. Whereas, eleven basic colours which are seen as *boring* are likely to be seen as *passive* because of the bipolarity of the attitudes. Besides, the basic colours which are perceived as *entertaining* tend to be seen as *vivid* (*r*= 0.90), *charming* (*r*= 0.88), *exciting* (*r*= 0.87), *dynamic* (*r*= 0.87), *energetic* (*r*= 0.85), *alive* (*r*= 0.85), *conspicuous* (*r*= 0.84) and *bright* (*r*= 0.84), and vice versa.

- The attitude *dominant-recessive* is very closely associated with the attitudes *vivid-pale* (*r*= 0.88) and *conspicuous-inconspicuous* (*r*= 0.88). This indicates that eleven basic colours which are construed as *dominant* tend to be perceived as *vivid* and *conspicuous*. Whereas, eleven basic colours which are seen as *recessive* are likely to be seen as *pale* and *inconspicuous* because of the bipolarity of the attitudes. Besides, the basic colours which are perceived as *dominant* tend to be seen as *aggressive* (*r*= 0.82) and vice versa.

- The attitude *cheerful-sad* is very closely associated with the attitudes *dynamic-static* (*r*= 0.93) and *charming-charmless* (*r*= 0.93). This indicates that eleven basic colours which are construed as *cheerful* tend to be perceived as *dynamic* and *charming*. Whereas, eleven basic colours which are seen as *sad* are likely to be seen as *static* and *charmless* because of the bipolarity of the attitudes. Besides, the basic colours which are perceived as *cheerful* tend to be seen as *alive* (*r*= 0.91), *bright* (*r*= 0.90), *active* (*r*= 0.89), *energetic* (*r*= 0.88), *exciting* (*r*= 0.86) and *frivolous* (*r*= 0.84), and vice versa.

- The attitude *bright-dim* is very closely associated with the attitude *alive-inanimate* (*r*= 0.91). This indicates that eleven basic colours which are construed as *bright* tend to be perceived as *alive*. Whereas, eleven basic colours which are seen as *dim* are likely to be seen as *inanimate* because of the bipolarity of the attitudes. Besides, the basic colours which are perceived as *bright* tend to be seen as *dynamic* (*r*= 0.90), *cheerful* (*r*= 0.90), *active* (*r*= 0.89), *conspicuous* (*r*= 0.88), *vivid* (*r*= 0.86), *energetic* (*r*= 0.86), *charming* (*r*= 0.86), *entertaining* (*r*= 0.84) and *exciting* (*r*= 0.81), and vice versa.

- The attitude *harmonious-disharmonious* is inversely associated with the other attitudes and is closely, but inversely, associated with the attitude *frivolous-solemn* (*r*= -0.81). This indicates that eleven basic colours which are construed as *harmonious* tend to be perceived as *solemn*. On the other hand, eleven basic colours which are seen as *disharmonious* are likely to be seen as *frivolous*.

- The attitude *frivolous-solemn* is closely associated with the attitude *cheerful-sad* (*r*= 0.84). This indicates that eleven basic colours which are construed as *frivolous* tend to be perceived as *cheerful*. Whereas, eleven basic colours which are seen as *solemn* are likely to be seen as *sad* because of the bipolarity of the attitudes. Besides, the basic colours which are perceived as *frivolous* tend to be seen as *charming* (*r*= 0.82) and *disharmonious* (*r*= -0.81), and vice versa.

- The attitude *aggressive-calm* is closely associated with the attitude *dominant-recessive* (*r*= 0.82). This indicates that eleven basic colours which are construed as *aggressive* tend to be perceived as *dominant*. Whereas, eleven basic colours which are seen as *calm* are likely to be seen as *recessive* because of the bipolarity of the attitudes.

- The attitude *extraordinary-ordinary* has no close associations with the other attitudes overall.

- The attitude *expressive-unexpressive* is closely associated with the attitude *conspicuous-inconspicuous* (*r*= 0.83). This indicates that eleven basic colours which are construed as *expressive* tend to be perceived as *conspicuous*. Whereas, eleven basic colours which are seen as *unexpressive* are likely to be seen as *inconspicuous* because of the bipolarity of the attitudes.

One problem with the correlation matrix of Table 6.7 is that it presents relatively a large amount of information. Therefore, the root-mean-square (RMS) among the attitudes within the *activity* factor was calculated in order to find the average level of correlation for each attitude. RMS is a statistical measure which indicates the magnitude of a varying quantity. It is the square root of the mean of the squares of the values (Fransella et al., 2004). Table 6.8 shows these values. As a result, the attitude *active-passive* is the most associated attitude with other attitudes overall within the *activity* factor. The attitudes *exciting-calming*, *vivid-pale*, *energetic-calm* and *dynamic-static* are the next most closely associated attitudes with others.

Table 6.8 Root-mean-square (average) correlations among 19 attitudes within *activity* factor

Attitude	root-mean-square correlation
exciting-calming	**0.84**
vivid-pale	**0.84**
energetic-calm	**0.84**
dynamic-static	**0.84**
active-passive	**0.85**
conspicuous-inconspicuous	0.81
soothing-disturbing	0.76
alive-inanimate	0.82
charming-charmless	0.82
warm-cool	0.71
entertaining-boring	0.79
dominant-recessive	0.69
cheerful-sad	0.76
bright-dim	0.76
harmonious-disharmonious	0.58
frivolous-solemn	0.67
aggressive-calm	0.57
extraordinary-ordinary	0.60
expressive-unexpressive	0.61
Average of statistic	0.75
Standard deviation of statistic	0.10

6.2.1.2 Results of Correlations among the Common Attitudes within *Lightness-Purity* Factor

The *lightness-purity* factor contains 15 attitudes. Pearson product-moment correlation of each attitude was calculated. Table 6.9 displays the correlation matrix among 15 attitudes within the *lightness-purity* factor. Again, it is important to note that, the negative correlations indicate the left pole of one attitude is associated with the right pole of the other attitude. The correlation matrix in Table 6.8 is interpreted as follows;

- The attitude *heavy-light* is inversely associated with the other attitudes overall, and is very closely, but inversely, associated with the attitude *light-dark* (*r*= -0.96). This indicates that eleven basic colours which are construed as *heavy* tend to be perceived as *dark*. Conversely, eleven basic colours which are seen as *light* (opposite of *heavy*) are likely to be seen as *light* (opposite of *dark*). Besides, the basic colours which are perceived as *heavy* tend to be seen as *malicious* (*r*= -0.94), *dark* (opposite of *luminous*) (*r*= -0.93), *suffocating* (*r*= -0.91), *hard* (*r*= 0.88), *restless* (*r*= -0.86), *complex* (*r*= -0.85), *impure* (*r*= -0.84), *dirty* (*r*= -0.81) and *negative* (*r*= -0.80), and vice versa.

- The attitude *refreshing-suffocating* is very closely associated with the attitude *positive-negative* (*r*= 0.95). This indicates that eleven basic colours which are construed as *refreshing* tend to be perceived as *positive*. Oppositely, eleven basic colours which are seen as *suffocating* are likely to be seen as *negative* because of the bipolarity of the attitudes. Besides, the basic colours which

are perceived as *refreshing* tend to be seen as *luminous* (*r*= 0.94), *innocent* (*r*= 0.92), *light* (opposite of *dark*) (*r*= 0.92), *light* (opposite of *heavy*) (*r*= -0.91), *clean* (*r*= 0.91), *optimistic* (*r*= 0.90), *cheering* (*r*= 0.89), *pure* (*r*= 0.88), *clear* (*r*= 0.80) and *sincere* (*r*= 0.80), and vice versa.

- The attitude *innocent-malicious* is very closely associated with the attitude *luminous-dark* (*r*= 0.96). This indicates that eleven basic colours which are construed as *innocent* tend to be perceived as *luminous*. Conversely, eleven basic colours which are seen as *malicious* are likely to be seen as *dark* because of the bipolarity of the attitudes. Besides, the basic colours which are perceived as *innocent* tend to be seen as *light* (opposite of *heavy*) (*r*= -0.94), *refreshing* (*r*= 0.92), *light* (opposite of *dark*) (*r*= 0.92), *clean* (*r*= 0.88), *positive* (*r*= 0.88), *soft* (*r*= -0.84), *optimistic* (*r*= 0.84), *immature* (*r*= -0.84), *cheering* (*r*= 0.82), *restful* (*r*= 0.81) and *pure* (*r*= 0.80), and vice versa.

- The attitude *light-dark* is very closely associated with the attitude *luminous-dark* (*r*= 0.97). This indicates that eleven basic colours which are construed as *light* tend to be perceived as *luminous*. Conversely, eleven basic colours which are seen as *dark* are likely to be seen as *dark* because of the bipolarity of the attitudes. Besides, the basic colours which are perceived as *light* tend to be seen as *light* (opposite of *heavy*) (*r*= -0.96), *refreshing* (*r*= 0.92), *innocent* (*r*= 0.92), *clear* (*r*= 0.84), *clean* (*r*= 0.83), *soft* (*r*= -0.82) and *positive* (*r*= 0.84), and vice versa.

- The attitude *pure-impure* is very closely associated with the attitude *restful-restless* (*r*= 0.90). This indicates that eleven basic colours which are construed as *pure* tend to be perceived as *restful*. Oppositely, eleven basic colours which are seen as *impure* are likely to be seen as *restless* because of the bipolarity of the attitudes. Besides, the basic colours which are perceived as *pure* tend to be seen as *refreshing* (*r*= 0.88), *sincere* (*r*= 0.87), *light* (opposite of *heavy*) (*r*= -0.84), *innocent* (*r*= 0.80) and *clean* (*r*= 0.80), and vice versa.

- The attitude *luminous-dark* is very closely associated with the attitude *light-dark* (*r*= 0.97). This indicates that eleven basic colours which are construed as *luminous* tend to be perceived as *light*. Oppositely, eleven basic colours which are seen as *dark* are likely to be seen as *dark* because of the bipolarity of the attitudes. Besides, the basic colours which are perceived as *luminous* tend to be seen as *innocent* (*r*= 0.96), *refreshing* (*r*= 0.94), *light* (opposite of *heavy*) (*r*= -0.93), *clean* (*r*= 0.91), *positive* (*r*= 0.88), *optimistic* (*r*= 0.86) and *cheering* (*r*= 0.86), and vice versa.

- The attitude *restful-restless* is very closely associated with the attitude *pure-impure* (*r*= 0.90). This indicates that eleven basic colours which are construed as *restful* tend to be perceived as *pure*. Conversely, eleven basic colours which are seen as *restless* are likely to be seen as *impure* because of the bipolarity of the attitudes. Besides, the basic colours which are perceived as *restful* tend to be seen as *light* (opposite of *heavy*) (*r*= -0.86) and *innocent* (*r*= 0.81), and vice versa.

- The attitude *clean-dirty* is very closely associated with the attitudes *refreshing-suffocating* (*r*= 0.91) and *luminous-dark* (*r*= 0.91). This indicates that eleven basic colours which are construed as *clean* tend to be perceived as *refreshing* and *luminous*. Conversely, eleven basic colours which are seen as *dirty* are likely to be seen as *suffocating* and *dark* because of the bipolarity of the attitudes. Besides, the basic colours which are perceived as *clean* tend to be seen as *positive* (*r*= 0.90), *innocent* (*r*= 0.88), *optimistic* (*r*= 0.87), *cheering* (*r*= 0.86), *light* (opposite of *dark*) (*r*= 0.83), *light* (opposite of *heavy*) (*r*= -0.81) and *pure* (*r*= 0.80), and vice versa.

Table 6.9 Correlation matrix among 15 attitudes within *lightness-purity* factor

	Attitude														
Attitude	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
1. heavy-light	**1.00**	-0.91	-0.94	-0.96	-0.84	-0.93	-0.86	-0.81	-0.80	**0.88**	**-0.85**	-0.72	-0.64	-0.70	0.70
2. refreshing-suffocating	-0.91	**1.00**	0.92	0.92	0.88	0.94	0.77	**0.91**	0.95	-0.66	0.80	0.90	0.80	0.89	-0.78
3. innocent-malicious	-0.94	0.92	**1.00**	0.92	0.80	0.96	0.81	0.88	0.88	-0.84	0.70	0.84	0.69	0.82	-0.84
4. light-dark	**-0.96**	0.92	0.92	**1.00**	0.78	**0.97**	0.74	0.83	0.81	-0.82	0.84	0.78	0.64	0.79	-0.70
5. pure-impure	-0.84	0.88	0.80	0.78	**1.00**	0.79	**0.90**	0.80	0.78	-0.66	0.72	0.72	**0.87**	0.63	-0.56
6. luminous-dark	-0.93	0.94	**0.96**	**0.97**	0.79	**1.00**	0.71	**0.91**	0.88	-0.76	0.78	0.86	0.73	0.86	-0.76
7. restful-restless	-0.86	0.77	0.81	0.74	**0.90**	0.71	**1.00**	0.64	0.63	-0.83	0.62	0.57	0.65	0.45	-0.55
8. clean-dirty	-0.81	0.91	0.88	0.83	0.80	0.91	0.64	**1.00**	0.90	-0.56	0.76	0.87	0.76	0.86	-0.73
9. positive-negative	-0.80	**0.95**	0.88	0.81	0.78	0.88	0.63	0.90	**1.00**	-0.53	0.67	**0.96**	0.77	**0.96**	**-0.89**
10. hard-soft	0.88	-0.66	-0.84	-0.82	-0.66	-0.76	-0.83	-0.56	-0.53	**1.00**	-0.58	-0.51	-0.40	-0.43	0.60
11. clear-complex	-0.85	0.80	0.70	0.84	0.72	0.78	0.62	0.76	0.67	-0.58	**1.00**	0.54	0.49	0.58	-0.42
12. optimistic-pessimistic	-0.72	0.90	0.84	0.78	0.72	0.86	0.57	0.87	**0.96**	-0.51	0.54	**1.00**	0.77	0.95	**-0.89**
13. sincere-insincere	-0.64	0.80	0.69	0.64	0.87	0.73	0.65	0.76	0.77	-0.40	0.49	0.77	**1.00**	0.71	-0.51
14. cheering-gloomy	-0.70	0.89	0.82	0.79	0.63	0.86	0.45	0.86	**0.96**	-0.43	0.58	0.95	0.71	**1.00**	-0.86
15. mature-immature	0.70	-0.78	-0.84	-0.70	-0.56	-0.76	-0.55	-0.73	-0.89	0.60	-0.42	-0.89	-0.51	-0.86	**1.00**

- The attitude *positive-negative* is very closely associated with the attitudes *optimistic-pessimistic* (*r*= 0.96) and *cheering-gloomy* (*r*= 0.96). This indicates that eleven basic colours which are construed as *positive* tend to be perceived as *optimistic* and *cheering*. Conversely, eleven basic colours which are seen as *negative* are likely to be seen as *pessimistic* and *gloomy* because of the bipolarity of the attitudes. Besides, the basic colours which are perceived as *positive* tend to be seen as *refreshing* (*r*= 0.95), *clean* (*r*= 0.90), *immature* (*r*= -0.89), *innocent* (*r*= 0.88), *luminous* (*r*= 0.88), *light* (opposite of *dark*) (*r*= 0.81) and *light* (opposite of *heavy*) (*r*= -0.80), and vice versa.

- The attitude *hard-soft* is inversely associated with the other attitudes overall, and is closely, but directly, associated with the attitude *heavy-light* (*r*= 0.88). This indicates that eleven basic colours which are construed as *hard* tend to be perceived as *heavy*. Conversely, eleven basic colours which are seen as *soft* are likely to be seen as *light* because of the bipolarity of the attitudes. Besides, the basic colours which are perceived as *hard* tend to be seen as *malicious* (*r*= -0.84), *restless* (*r*= -0.83) and *dark* (opposite of *light*) (*r*= -0.82), and vice versa.

- The attitude *clear-complex* is inversely associated with the attitude *heavy-light* (*r*= -0.85). This indicates that eleven basic colours which are construed as *clear* tend to be perceived as *light*. Conversely, eleven basic colours which are seen as *complex* are likely to be seen as *heavy* because of the bipolarity of the attitudes. Besides, the basic colours which are perceived as *clear* tend to be seen as *light* (opposite of *dark*) (*r*= 0.84) and *refreshing* (*r*= 0.80), and vice versa.

- The attitude *optimistic-pessimistic* is very closely associated with the attitude *positive-negative* (*r*= 0.96). This indicates that eleven basic colours which are construed as *optimistic* tend to be perceived as *positive.* Conversely, eleven basic colours which are seen as *pessimistic* are likely to be seen as *negative* because of the bipolarity of the attitudes. Besides, the basic colours which are perceived as *optimistic* tend to be seen as *cheering* (*r*= 0.95), *refreshing* (*r*= 0.90), *immature* (*r*= -0.89), *clean* (*r*= 0.87), *luminous* (*r*= 0.86) and *innocent* (*r*= 0.84), and vice versa.

- The attitude *sincere-insincere* is closely associated with the attitude *pure-impure* (*r*= 0.87). This indicates that eleven basic colours which are construed as *sincere* tend to be perceived as *pure.* Conversely, eleven basic colours which are seen as *insincere* are likely to be seen as *impure* because of the bipolarity of the attitudes. Besides, the basic colours which are perceived as *sincere* tend to be seen as *refreshing* (*r*= 0.80), and vice versa.

- The attitude *cheering-gloomy* is very closely associated with the attitude *positive-negative* (*r*= 0.96). This indicates that eleven basic colours which are construed as *cheering* tend to be perceived as *positive.* Conversely, eleven basic colours which are seen as *gloomy* are likely to be seen as *negative* because of the bipolarity of the attitudes. Besides, the basic colours which are perceived as *cheering* tend to be seen as *optimistic* (*r*= 0.95), *refreshing* (*r*= 0.89), *luminous* (*r*= 0.86), *clean* (*r*= 0.86), *immature* (*r*= -0.86) and *innocent* (*r*= 0.82), and vice versa.

- The attitude *mature-immature* is inversely associated with the other attitudes overall which is closely, but inversely, associated with the attitudes *positive-negative* (*r*= -0.89) and *optimistic-pessimistic* (*r*= -0.89). This indicates that eleven basic colours which are construed as *mature* tend to be perceived as *negative* and *pessimistic*. Conversely, eleven basic colours which are seen as *immature* are likely to be seen as *positive* and *optimistic* because of the bipolarity of the attitudes. Besides, the basic colours which are perceived as *mature* tend to be seen as *gloomy* (*r*= -0.86), and *malicious* (*r*= -0.84), and vice versa.

Yet again, one problem with the correlation matrix of Table 6.9 is, it presents relatively a large amount of information. Therefore, the root-mean-square (RMS) among the attitudes within the *lightness-purity* factor was calculated in order to find the average level of correlation for each attitude. Table 6.10 shows the values of the RMS correlations among 15 attitudes. As a result, the attitude *refreshing-suffocating* is the most associated attitude with other attitudes overall within the

lightness-purity factor. The attitudes *innocent-malicious* and *luminous-dark* are the next most closely associated attitudes with the others.

Table 6.10 Root-mean-square (average) correlations among 15 attitudes within *lightness-purity* factor

Attitude	root-mean-square correlation
heavy-light	0.83
refreshing-suffocating	**0.86**
innocent-malicious	**0.85**
light-dark	0.83
pure-impure	0.77
luminous-dark	**0.85**
restful-restless	0.71
clean-dirty	0.81
positive-negative	0.82
hard-soft	0.67
clear-complex	0.68
optimistic-pessimistic	0.79
sincere-insincere	0.69
cheering-gloomy	0.77
mature-immature	0.71
Average of statistic	0.78
Standard deviation of statistic	0.07

6.2.1.3 Results of Correlations among the Common Attitudes within *Evaluation* Factor

The *evaluation* factor contains three attitudes. Pearson product-moment correlation of each attitude was calculated. Table 6.11 displays the correlation matrix among three attitudes within the *evaluation* factor. The correlation matrix in Table 6.11 is interpreted as follows;

- The attitude *beautiful-ugly* is closely associated with the attitude *attractive-repulsive* (*r*= 0.81). This indicates that eleven basic colours which are construed as *beautiful* tend to be perceived as *attractive.* Conversely, eleven basic colours which are seen as *ugly* are likely to be seen as *repulsive* because of the bipolarity of the attitudes.

- The attitude *modern-traditional* has no close associations with the other attitudes.

- The attitude *attractive-repulsive* is closely associated with the attitude *beautiful-ugly* (*r*= 0.81). This indicates that eleven basic colours which are construed as *attractive* tend to be perceived as *beautiful.* Conversely, eleven basic colours which are seen as *repulsive* are likely to be seen as *ugly* because of the bipolarity of the attitudes.

Table 6.11 Correlation matrix among three attitudes within *evaluation* factor

	Attitude		
Attitude	**1**	**2**	**3**
1. beautiful-ugly	**1.00**	0.74	**0.81**
2. modern-traditional	0.74	**1.00**	0.36
3. attractive-repulsive	**0.81**	0.36	**1.00**

In order to find the average level of correlation for each attitude, the root-mean-square (RMS) among the attitudes within the *evaluation* factor was calculated. Table 6.12 shows the values of the RMS correlations among three attitudes. As a result, the attitude *beautiful-ugly* is the most associated attitude with other attitudes overall within the *evaluation* factor.

Table 6.12 Root-mean-square (average) correlations among three attitudes within *evaluation* factor

Attitude	**root-mean-square correlation**
beautiful-ugly	**0.78**
modern-traditional	0.58
attractive-repulsive	0.63
Average of statistic	0.66
Standard deviation of statistic	0.10

6.2.1.4 Results of Correlations among the Common Attitudes within *Familiarity* Factor

The *familiarity* factor contains four attitudes. Pearson product-moment correlation of each attitude was calculated. Table 6.13 displays the correlation matrix among four attitudes within the *familiarity* factor which is interpreted as follows;

- The attitude *familiar-unfamiliar* is closely associated with the attitude *common-rare* (*r*= 0.85). This indicates that eleven basic colours which are construed as *familiar* tend to be perceived as *common.* Conversely, eleven basic colours which are seen as *unfamiliar* are likely to be seen as *rare* because of the bipolarity of the attitudes.

- The attitude *natural-artificial has* no close associations with the other attitudes.

- The attitude *common-rare* is closely associated with the attitude *familiar-unfamiliar* (*r*= 0.85). This indicates that eleven basic colours which are construed as *common* tend to be perceived as *familiar.* Conversely, eleven basic colours which are seen as *rare* are likely to be seen as un*familiar* because of the bipolarity of the attitudes.

- The attitude *strong-weak has* no close associations with the other attitudes.

Table 6.13 Correlation matrix among four attitudes within *familiarity* factor

	Attitude			
Attitude	**1**	**2**	**3**	**4**
1. familiar-unfamiliar	**1.00**	0.57	**0.85**	0.25
2. natural-artificial	0.57	**1.00**	0.34	0.36
3. common-rare	**0.85**	0.34	**1.00**	0.26
4. strong-weak	0.25	0.36	0.26	**1.00**

In order to find the average level of correlation for each attitude, the root-mean-square (RMS) among the attitudes within the *familiarity* factor was calculated. Table 6.14 shows the values of the RMS correlations among four attitudes. As a result, the attitude *familiar-unfamiliar* is the most associated attitude with other attitudes overall within the *familiarity* factor.

Table 6.14 Root-mean-square (average) correlations among four attitudes within *familiarity* factor

	root-mean-square
Attitude	**correlation**
familiar-unfamiliar	**0.61**
natural-artificial	0.44
common-rare	0.55
strong-weak	0.29
Average of statistic	0.47
Standard deviation of statistic	0.09

6.2.2 Hierarchical Cluster Analysis: The Relationships among Eleven Basic Colours within Each Four Factor

Cluster analysis is an exploratory data analysis tool which identifies groups of variables that behave similarly or show similar characteristics. It is a data reduction tool like factor analysis that creates subgroups and examines the interrelationships between variables. Although there are a variety of clustering procedures, *hierarchical clustering* is one of the most distinct methods. Hierarchical cluster analysis is a statistical method for identifying relatively homogeneous clusters of cases which uses the dissimilarities or distances between objects when forming the clusters. In hierarchical cluster analysis, both the *agglomeration method* and the *average-linkage-between-groups method* are often

used for determining similarity or distance between cases. The visual representation of the clustering is called the *dendrogram* which shows the distances of the combined clusters. It is a tree-like display that lists the cases which are clustered along the y-axis and the distance at which the cluster is formed along the x-axis (Kalaycı, 2010).

In RGT, Fransella et al. (2004) state that the use of hierarchical cluster analysis of correlations or distances is another way of indicating the relationships among either constructs or elements. Osbourn (1988, p. 231) claims that "[…] in the grid, [the use of] cluster analysis relies upon the building up of a series of hierarchical groups based upon the strongest associations in the matrix" which identifies the major groups and searches for the patterns. In accordance, the relationships among eleven basic colours within each factor, i.e. *activity*, *lightness-purity*, *evaluation* and *familiarity*, were investigated by conducting the hierarchical cluster analysis. This analysis provides information related to how two or more basic colours that displayed a high association in the ratings of the attitudes on each factor are combined. The patterns of the relationships among the clustered basic colours and their ratings on the attitudes within each factor are displayed by using the semantic differential charts[62]. These charts were done by using XLSTAT-MX which is an add-in statistical program of Microsoft Excel.

6.2.2.1 Results of Cluster Analysis among Eleven Basic Colours within *Activity* Factor

The hierarchical cluster analysis was computed on eleven basic colours in order to explore the relationships among them within the *activity* factor. The visual representation of the results of the clustering of the basic colours is displayed in the dendrogram in Figure 6.1.

The extreme left of the dendrogram in Figure 6.1 shows the list of basic colours, along the y-axis, with their names and coded numbers (see Section 4.10.3.3) and the distances (i.e. coefficients or squared Euclidian distance) at which the clusters of basic colours were formed using a 0 to 25 scale along the x-axis The algorithm in hierarchical clustering starts with each basic colour in a separate cluster and combines clusters until only one is left. Although the agglomeration schedule in Appendix K.1 provides a solution for 10 clusters, as it is seen in Figure 6.1, the dendrogram shows eight clear clusters. Each basic colour is considered as one cluster and the other basic colours are added to previous two colours until only one cluster is left.

The first vertical lines in the dendrogram, corresponding to the smallest rescaled distance, are for the cluster combinations of the basic colours which are *yellow* (4) and *orange* (5) in one group and *white* (3) and *blue* (10) in another group. The next vertical line shows the cluster combinations of the basic colours which are *grey* (2) and *brown* (9). Last, the basic colours which are *pink* and *purple* are clustered together as at the larger distances than the others. It is important to note that the bigger the distances of the basic colours that are combined, the bigger the differences in these basic colours. As a result, within the *activity* factor, the strongest associations in eleven basic colours are; i. *yellow* and *orange*, ii. *white* and *blue*, iii. *grey* and brown, and iv. *pink* and *purple*. The semantic differential charts in the following present the patterns of the basic colours among each group of cluster and their ratings on 19 attitudes in the *activity* factor.

[62] Semantic differential chart is the visualisation method of semantic differential which is developed by the psychologists Charles E. Osgood (1957) in order to plot the differences between individuals' connotations for a given word.

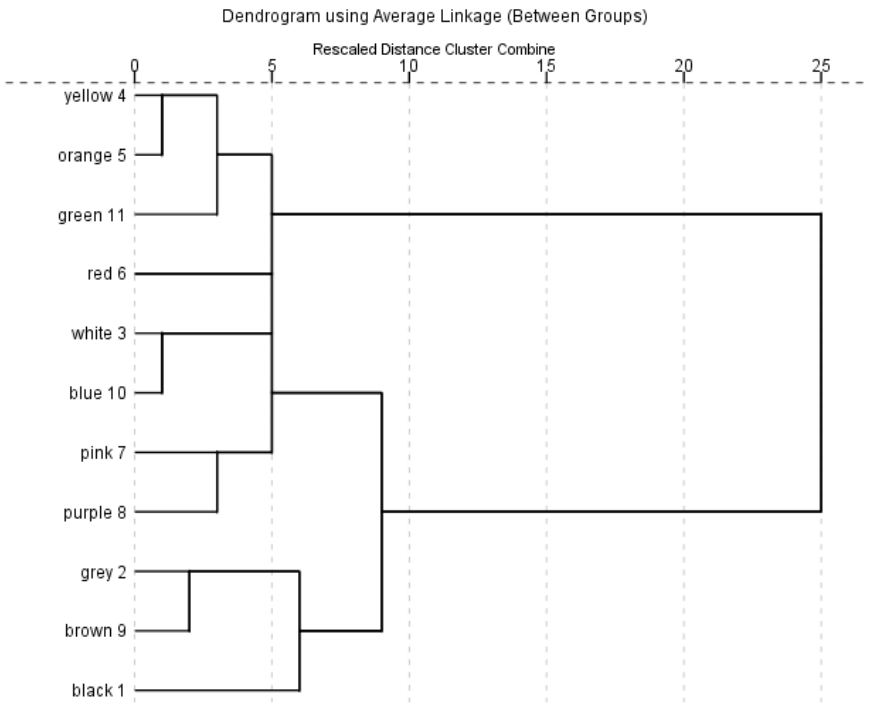


Figure 6.1 The dendrogram of the relationships among eleven basic colours within the *activity* factor

Figure 6.2 presents the patterns of the ratings of the basic colours, i.e. *yellow* and *orange*, on 19 attitudes in the semantic differential chart of the *activity* factor. In the chart, the vertical dotted line is used to show the midpoint, i.e. 4, of the 7-point rating scale running from 1 through 7. As it is seen, *yellow* and *orange* were rated more substantially by using the left poles more than the right poles of 19 attitudes. In other words, these colours were rated on the positive poles of the attitudes in the *activity* factor except the attitudes *soothing-disturbing* and *harmonious-disharmonious*. The participants rated *yellow* and *orange* on these attitudes by considering them as quite *disturbing* and slightly *disharmonious*. Although there are relatively small differences in the patterns of the ratings of the two colours, they were perceived as to have nearly identical ratings. In addition, *yellow* and *orange* have some overlapping ratings on some of the attitudes, as well. For instance, as it is seen in the semantic differential chart, these two basic colours were rated as quite *exciting*, extremely *energetic*, quite *dynamic*, quite *conspicuous*, quite *charming* and quite *bright*.

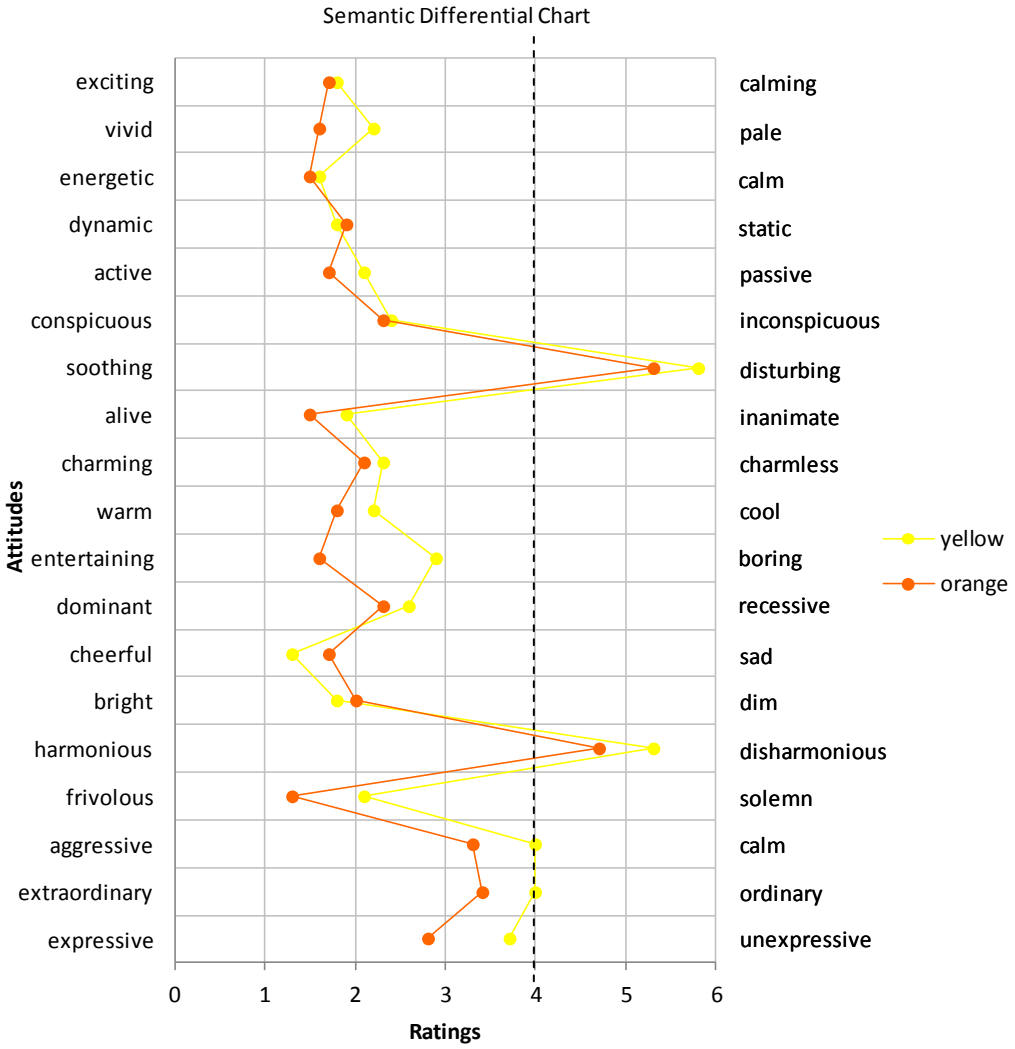


Figure 6.2 The patterns of the basic colours *yellow* and *orange* within *activity* factor

Figure 6.3 presents the patterns of the ratings of the basic colours, i.e. *white* and *blue*, on 19 attitudes in the semantic differential chart of the *activity* factor. In the chart, the vertical dotted line is used to show the midpoint, i.e. 4, of the 7-point rating scale. As it is seen, *white* and *blue* were rated more substantially by using the midpoint of the rating scale more than by using either the left poles or the right poles of 19 attitudes. In other words, these colours were rated by the participants by using the expression of *neither-nor* of the attitudes in the *activity* factor. In addition, *white* and *blue* have some overlapping ratings on some of the attitudes, as well. For instance; as it is seen in the semantic differential chart, these two basic colours were rated as slightly *calm* (opposite of *energetic*), neither *dynamic* nor *static*, neither *charming* nor *charmless*, neither *dominant* nor *recessive* and slightly *expressive*. As a result, even though there are relatively small differences of the patterns of the ratings of the two colours, they were perceived as to have nearly identical ratings.

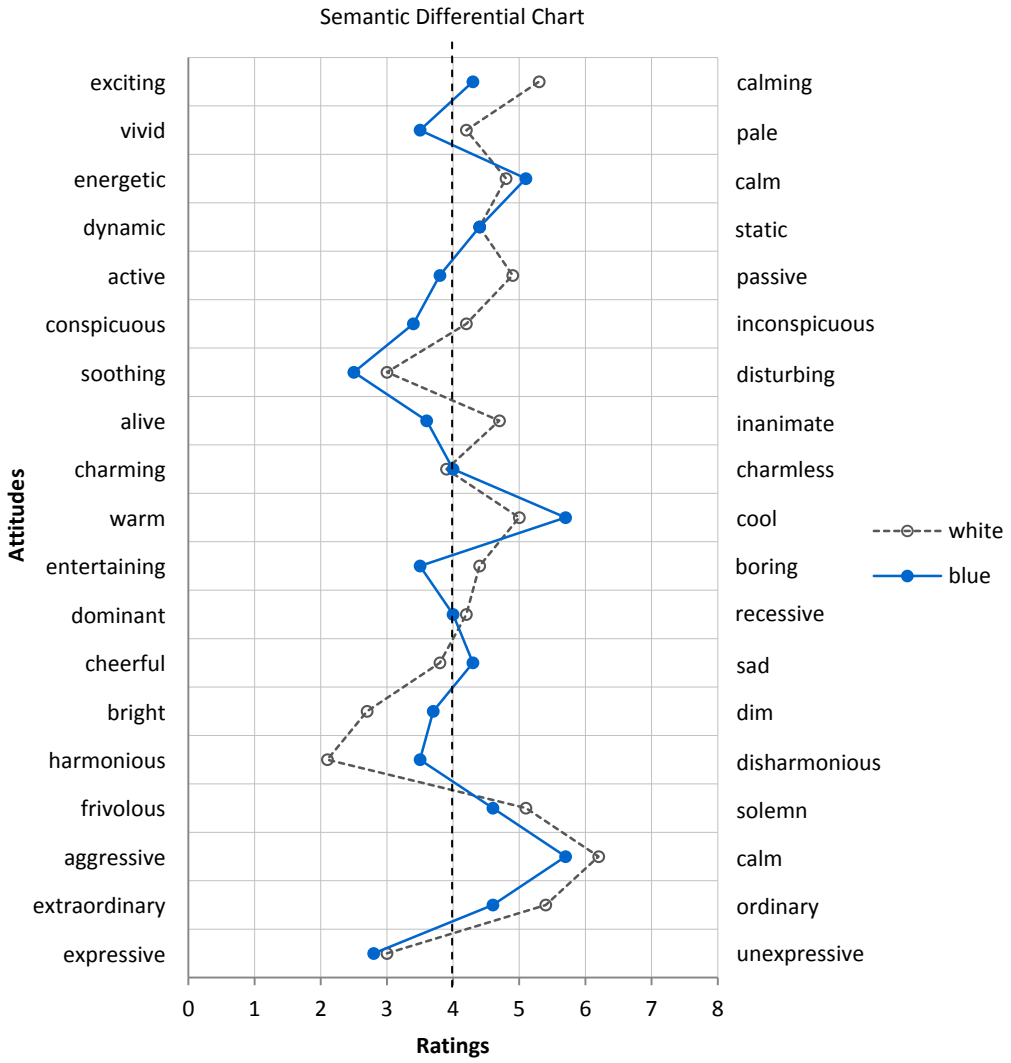


Figure 6.3 The patterns of the basic colours *white* and *blue* within *activity* factor

Figure 6.4 presents the patterns of the ratings of the basic colours, i.e. *grey* and *brown*, on 19 attitudes in the semantic differential chart of the *activity* factor. In the chart, the vertical dotted line is used to show the midpoint, i.e. 4, of the 7-point rating scale. As it is seen, *grey* and *brown* were rated more substantially by using the right poles more than the left poles of 19 attitudes. In other words, these colours were rated on the negative poles of the attitudes in the *activity* factor except the attitudes *soothing-disturbing* and *harmonious-disharmonious*. These two colours were rated as slightly *soothing*, on the other hand, while *grey* was rated as quite *harmonious*; *brown* was rated as neither *harmonious* nor *disharmonious*.

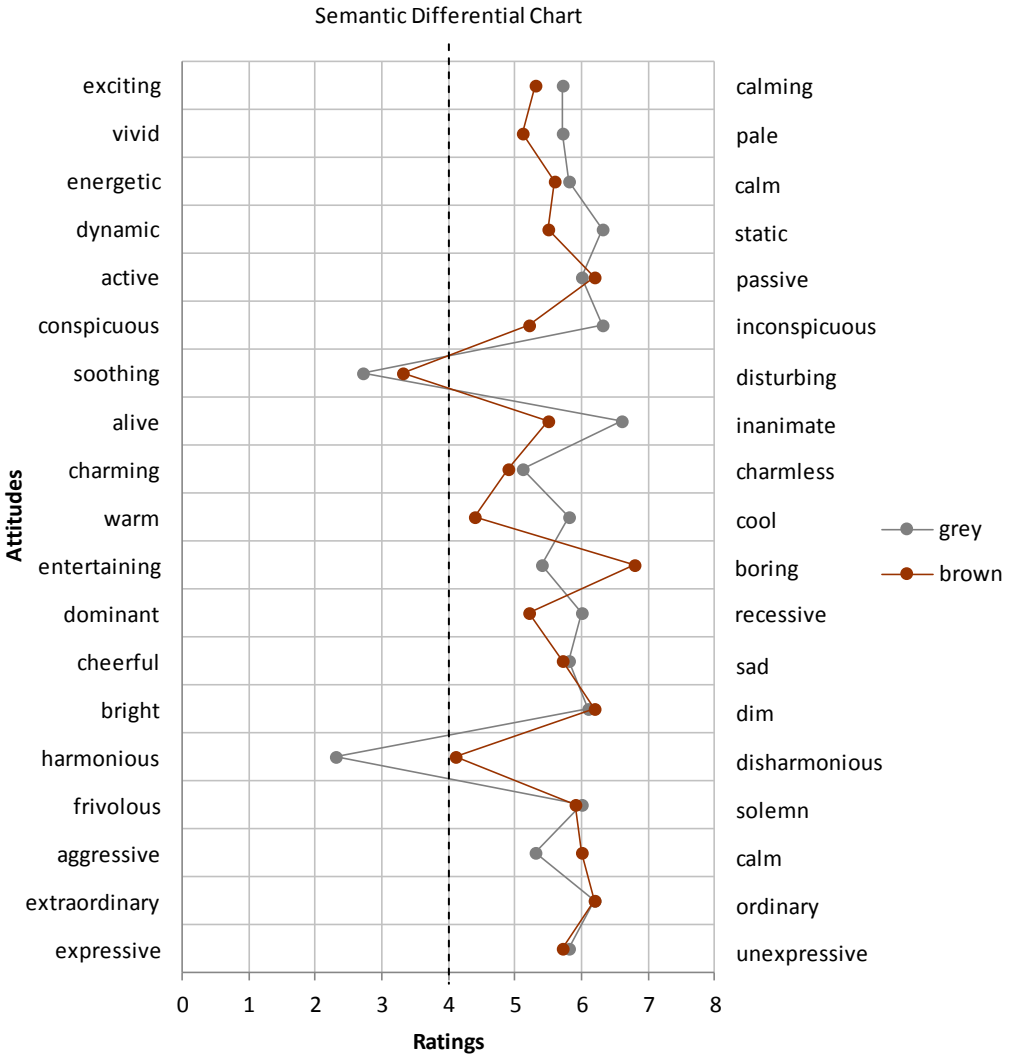


Figure 6.4 The patterns of the basic colours *grey* and *brown* within *activity* factor

There are some overlapping ratings of *grey* and *brown* on some of the attitudes, as well. For instance, the two colours were rated as quite *calm* (opposite of *energetic*), quite *passive*, slightly *charmless*, quite *sad*, quite *dim*, quite *solemn*, quite *ordinary* and quite *unexpressive*. As a result, although there are relatively small differences of the patterns of the ratings of these two colours, they were perceived as to have nearly identical ratings.

Figure 6.5 presents the patterns of the ratings of the basic colours, i.e. *pink* and *purple*, on 19 attitudes in the semantic differential chart of the *activity* factor. In the chart, the vertical dotted line is used to show the midpoint, i.e. 4, of the 7-point rating scale. As it is seen, *pink* and *purple* were rated by using both the right poles and the left poles of 19 attitudes. Although *pink* and *purple* are grouped together as the result of hierarchical cluster analysis because of their proximities in distances, they are clustered together as at the larger distances than *yellow* and *orange*, *white* and *blue*, and *grey* and *brown*. Therefore, it is important to remember that, the bigger the distances of the colours that are combined, the bigger the differences in the ratings of these colours. Although they have differences in ratings on the attitudes, there are some overlapping attitudes. For instance, these two basic colours were rated as slightly *inanimate*, slightly *dim* and slightly *disharmonious*.

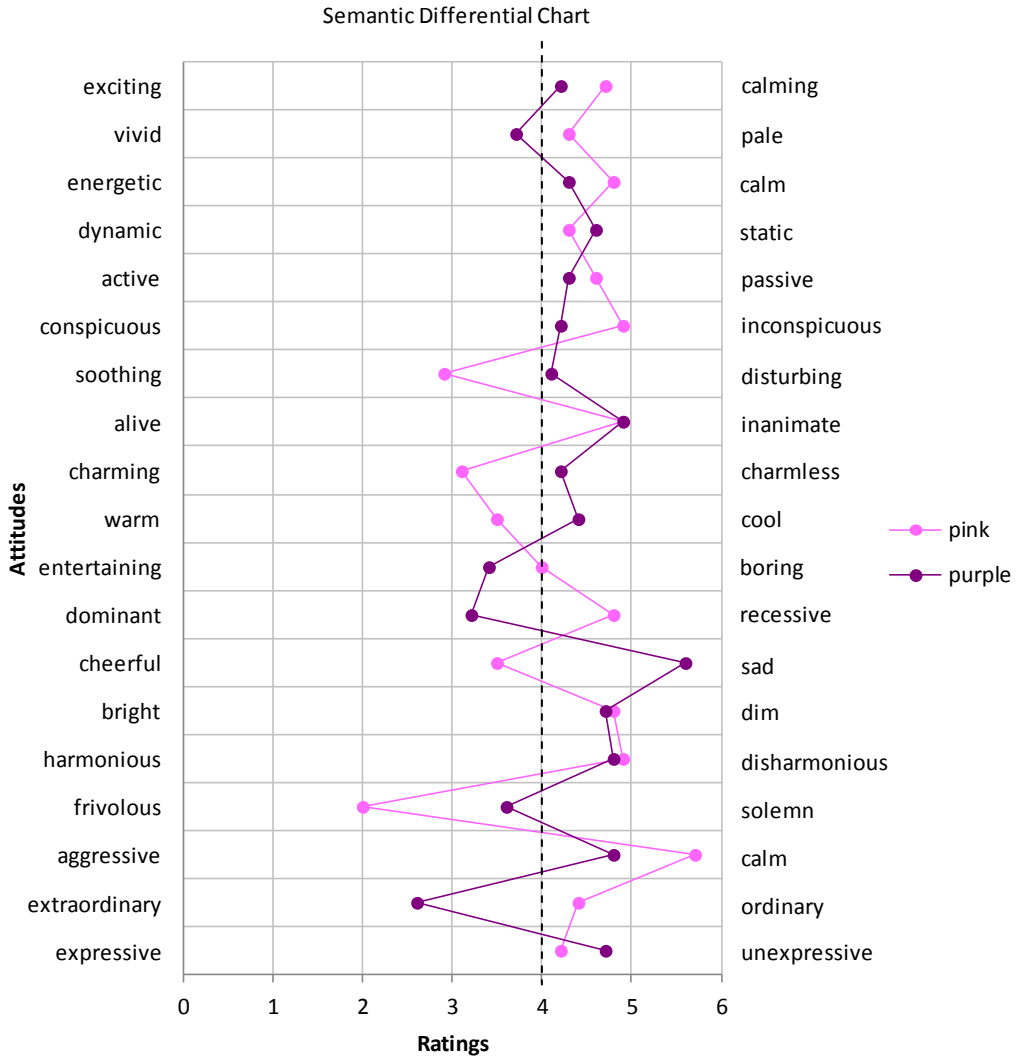


Figure 6.5 The patterns of the basic colours *pink* and *purple* within *activity* factor

6.2.2.2 Results of Cluster Analysis among Eleven Basic Colours within *Lightness-Purity* Factor

The hierarchical cluster analysis was computed on eleven basic colours in order to explore the relationships among them within the *lightness-purity* factor. The visual representation of the results of the clustering of the basic colours is displayed in the dendrogram in Figure 6.6.

The extreme left of the dendrogram in Figure 6.6 shows the list of basic colours, along the y-axis, with their names and coded numbers and the distances at which the clusters of basic colours were formed using a 0 to 25 scale along the x-axis. The algorithm in hierarchical clustering starts with each basic colour, in a separate cluster and combines clusters until only one is left. Although the agglomeration schedule in Appendix K.2 provides a solution for 10 clusters, as it is seen in Figure 6.6, the dendrogram shows five clear clusters. Each basic colour is considered as one cluster and the other basic colours are added to previous two or three colours until only one cluster is left.

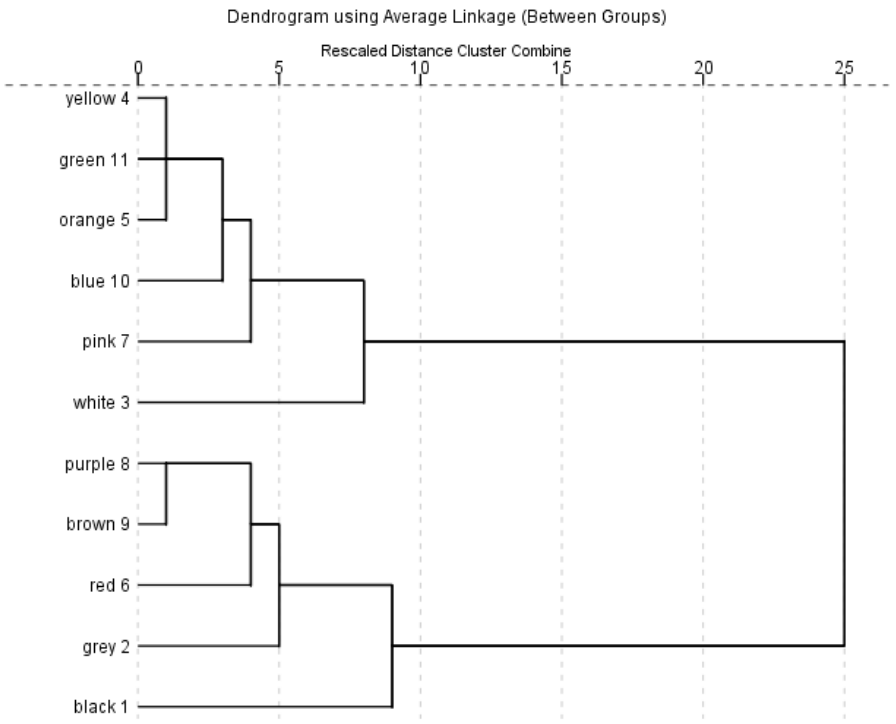


Figure 6.6 The dendrogram of the relationships among eleven basic colours within the *lightness-purity* factor

The first vertical lines in the dendrogram, corresponding to the smallest rescaled distance, are for the cluster combinations of the basic colours which are *yellow* (4), *orange* (5) and *green* (11) in one group and *purple* (8) and *brown* (9) in another group. As a result, within the *lightness-purity* factor, the strongest associations in eleven basic colours are; i. *yellow*, *orange* and green, and ii. *purple* and *brown*. The semantic differential charts in the following present the patterns of the basic colours among each group of cluster and their ratings on 15 attitudes in the *lightness-purity* factor.

Figure 6.7 presents the patterns of the ratings of the basic colours, i.e. *yellow*, *orange* and *green*, on 15 attitudes in the semantic differential chart of the *lightness-purity* factor. In the chart, the vertical dotted line is used to show the midpoint, i.e. 4, of the 7-point rating scale running from 1 through 7. As it is seen, *yellow*, *orange* and *green* were rated more substantially by using the left poles more than the right poles of 15 attitudes. In other words, these colours were rated on the positive poles of the attitudes in the *lightness-purity* factor except the attitudes *heavy-light* and *mature-immature*. While *yellow* and *green* were rated as slightly *light* (opposite of *heavy*), *orange* was rated as neither *heavy* nor *light*. Moreover, while *yellow* and *green* were rated as quite *immature,* orange was rated as extremely *immature*. *Yellow*, *orange* and *green* have some overlapping ratings on some of the attitudes, as well. For instance; as it is seen in the semantic differential chart, the three basic colours were rated as quite *positive* and neither *hard* nor *soft*. As a result, even though there are small differences of the patterns of the ratings of these three colours, they were perceived as nearly identical.

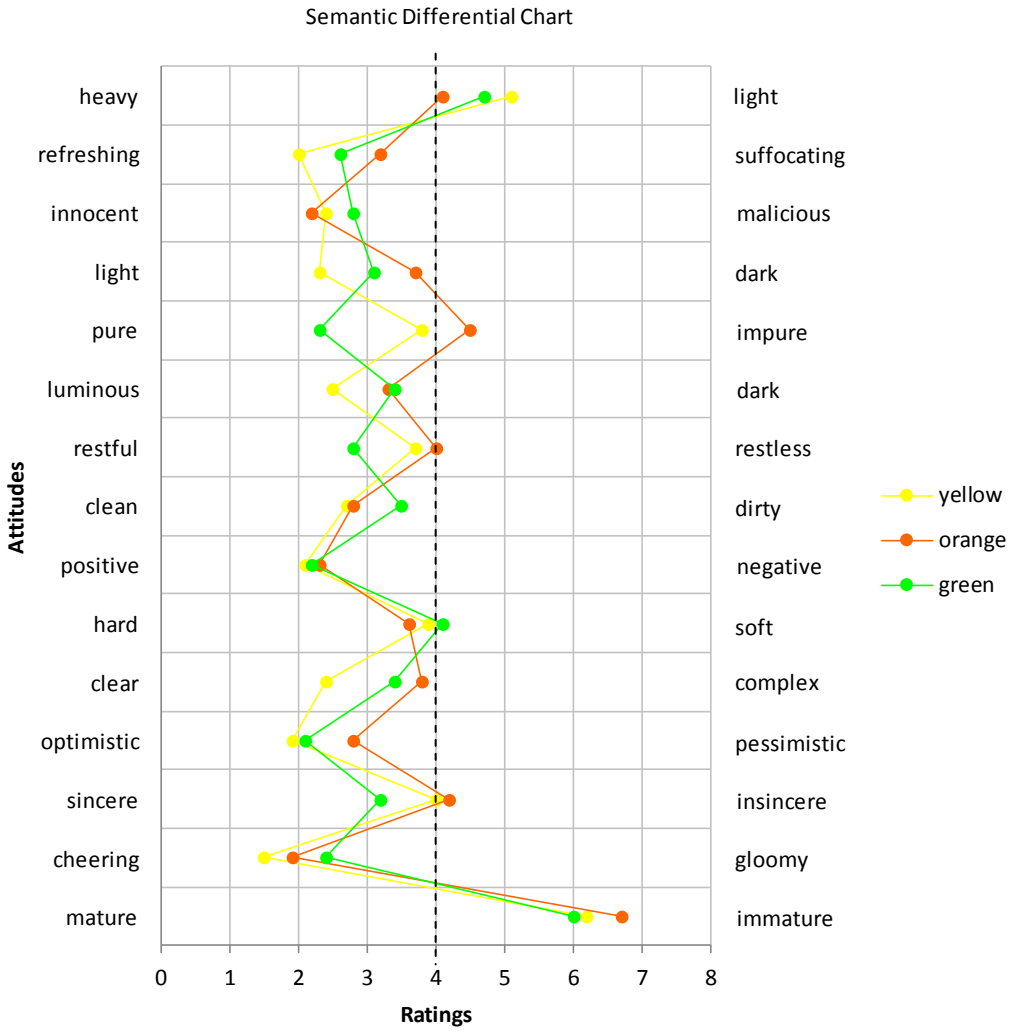


Figure 6.7 The patterns of the basic colours *yellow*, *orange* and *green* within *lightness-purity* factor

Figure 6.8 presents the patterns of the ratings of the basic colours, i.e. *purple* and *brown*, on 15 attitudes in the semantic differential chart of the *lightness-purity* factor. In the chart, the vertical dotted line is used to show the midpoint, i.e. 4, of the 7-point rating scale. As it is seen, *purple* and *brown* were rated more substantially by using the right poles more than the left poles of 15 attitudes. In other words, these colours were rated on the negative poles of the attitudes in the *lightness-purity* factor except the attitudes *heavy-light*, *hard-soft* and *mature-immature*. While *purple* was rated as slightly *heavy*, neither *hard* nor *soft* and neither *mature* nor *immature*, *brown* was rated as quite *heavy*, slightly *hard* and quite *mature*. As a result, although there are small differences of the patterns of the ratings of the two colours, they were perceived as to have nearly identical ratings. In addition, there are some overlapping ratings of *purple* and *brown* on some of the attitudes, as well. For instance, as it is seen in the semantic differential chart, these two colours were rated as quite *suffocating*, slightly *impure*, quite *complex*, and slightly *insincere.*

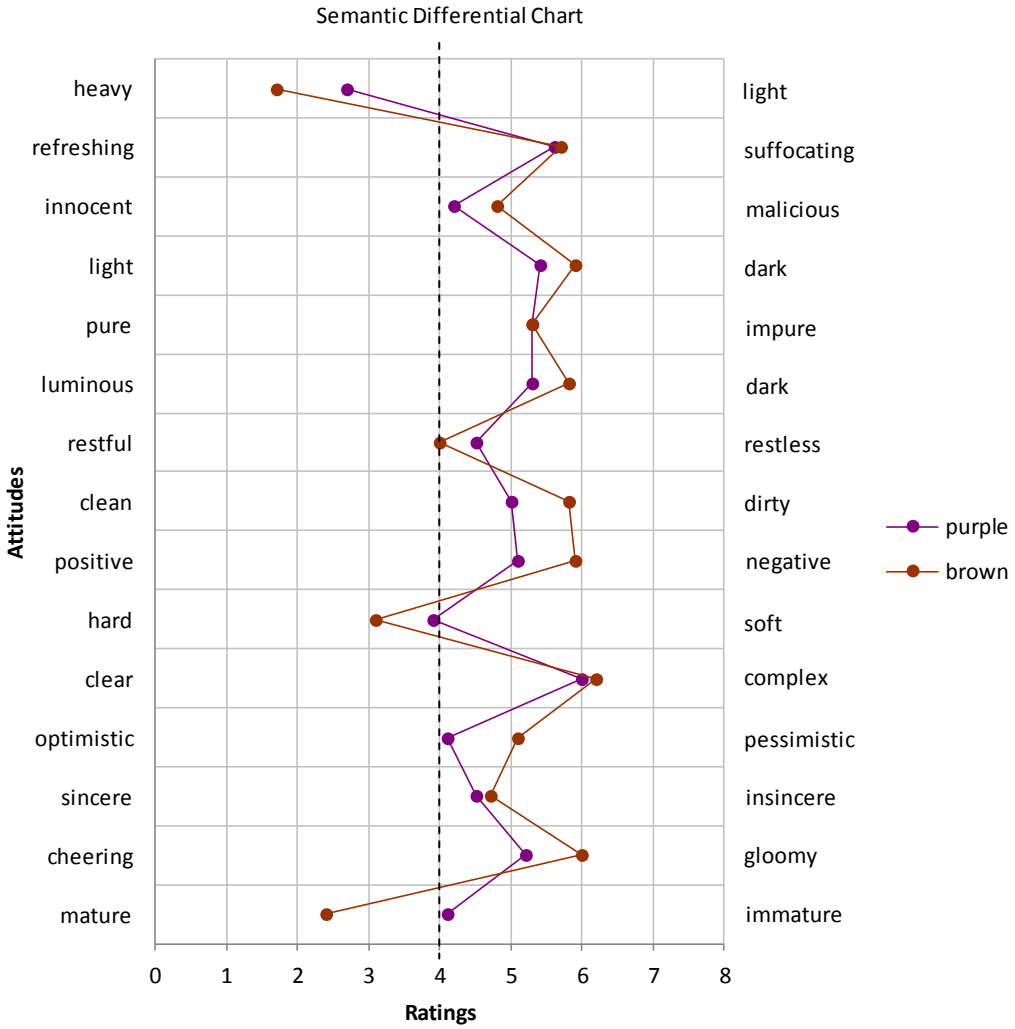


Figure 6.8 The patterns of the basic colours *purple* and *brown* within *lightness-purity* factor

6.2.2.3 Results of Cluster Analysis among Eleven Basic Colours within *Evaluation* Factor

The hierarchical cluster analysis was computed on eleven basic colours in order to explore the relationships among them within the *evaluation* factor. The visual representation of the results of the clustering of the basic colours is displayed in the dendrogram in Figure 6.9.

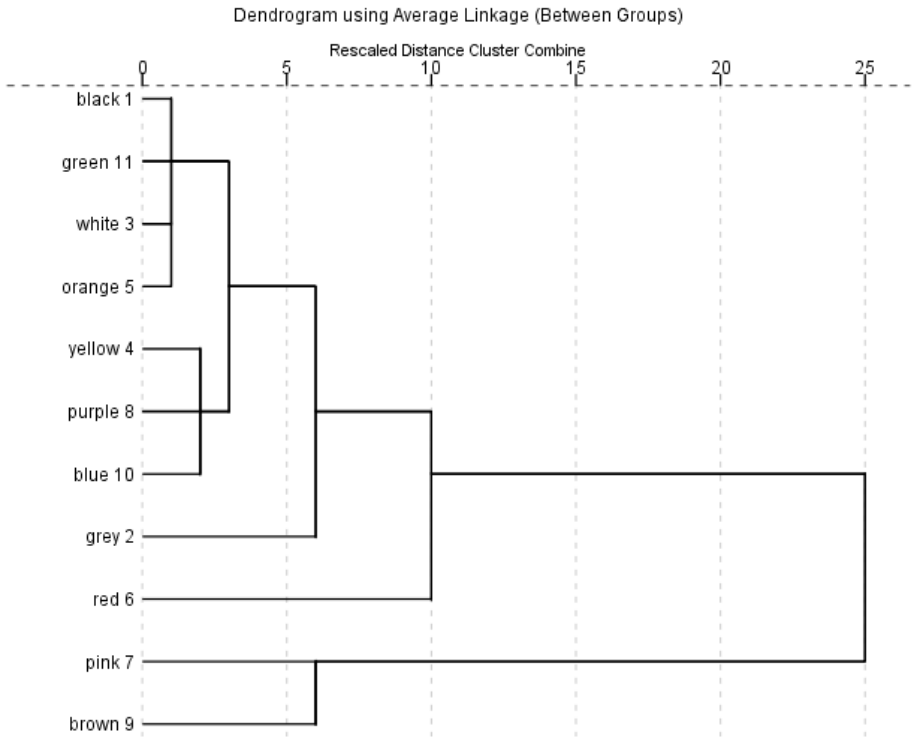


Figure 6.9 The dendrogram of the relationships among eleven basic colours within the *evaluation* factor

The extreme left of the dendrogram in Figure 6.9 shows the list of basic colours, along the y-axis, with their names and coded numbers and the distances at which the clusters of basic colours were formed using a 0 to 25 scale along the x-axis. The algorithm in hierarchical clustering starts with each basic colour, in a separate cluster and combines clusters until only one is left. Although the agglomeration schedule in Appendix K.3 provides a solution for 10 clusters, as it is seen in Figure 6.9, the dendrogram shows seven clear clusters. Each basic colour is considered as one cluster and the other basic colours are added to previous three or four colours until only one cluster is left.

The first vertical line in the dendrogram, corresponding to the smallest rescaled distance, is for the cluster combinations of the basic colours which are *black* (1), *green* (11), *white* (3) and *orange* (5) in one group. The next vertical line shows the cluster combinations of the basic colours which are *yellow* (4), *purple* (8) and *blue* (10) which are clustered together in another group as at the larger distances than the previous group. As a result, within the *evaluation* factor, the strongest associations in eleven basic colours are; i. *black*, *green*, *white* and *orange* and ii. *yellow*, *purple* and *blue*. The semantic differential charts in the following present the patterns of the basic colours among each group of cluster and their ratings on three attitudes in the *evaluation* factor.

Figure 6.10 presents the patterns of the ratings of the basic colours, i.e. *black*, *green*, *white* and *orange*, on three attitudes in the semantic differential chart of the *evaluation* factor. In the chart, the vertical dotted line is used to show the midpoint, i.e. 4, of the 7-point rating scale running from 1 to 7. As it is seen, *black*, *green*, *white* and *orange* were rated more substantially by using the left poles more than the right poles of three attitudes. In other words, these colours were rated on the positive poles of the attitudes in the *evaluation* factor. Although there are relatively small differences of the patterns of the ratings of the four colours, they were perceived as to have nearly identical ratings. These four colours were rated as slightly *beautiful*, slightly *modern* and slightly *attractive*.

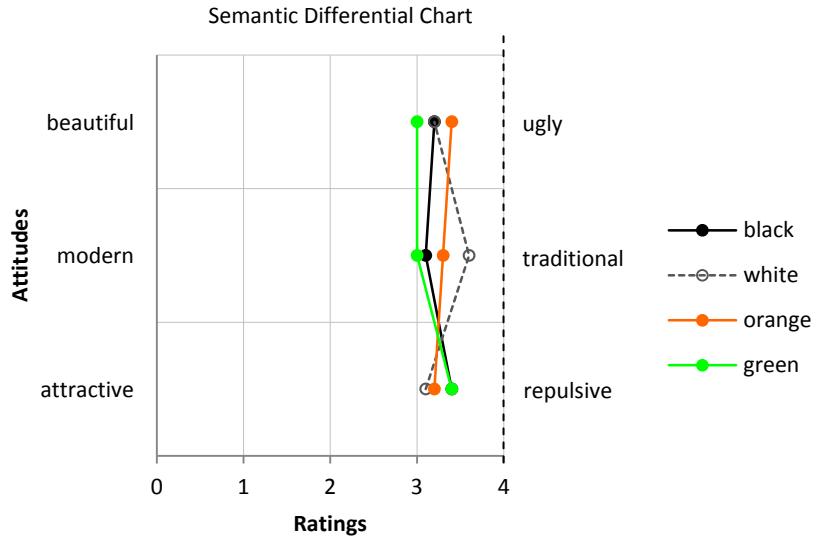


Figure 6.10 The patterns of the basic colours *black*, *green*, *white* and *orange* within *evaluation* factor

Figure 6.11 presents the patterns of the ratings of the basic colours, i.e. *yellow*, *purple* and *blue*, on three attitudes in the semantic differential chart of the *evaluation* factor. In the chart, the vertical dotted line is used to show the midpoint, i.e. 4, of the 7-point rating scale. As it is seen, *yellow*, *purple* and *blue* were rated more substantially by using the midpoint of the rating scale rather than by using either the left poles or the right poles of three attitudes. In other words, these colours were rated by the participants by using the expression of *neither-nor* of the attitudes in the *evaluation* factor except the attitude *modern-traditional*. While *purple* and *blue* were rated as neither *modern* nor *traditional*, *yellow* was rated as slightly *traditional*. As a result, even though there are relatively small differences of the patterns of the ratings of the three colours, they were perceived as to have nearly identical ratings.

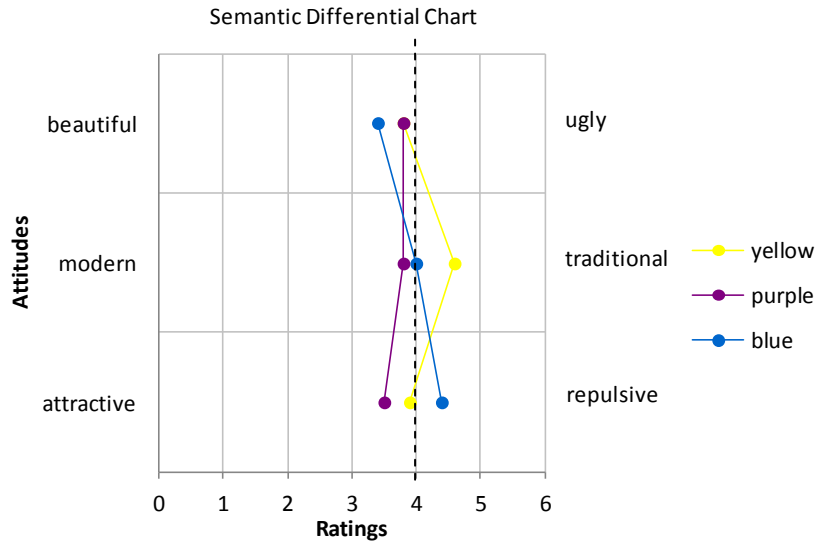


Figure 6.11 The patterns of the basic colours *yellow*, *purple* and *blue* within *evaluation* factor

6.2.2.4 Results of Cluster Analysis among Eleven Basic Colours within *Familiarity* Factor

The hierarchical cluster analysis was computed on eleven basic colours in order to explore the relationships among them within the *familiarity* factor. The visual representation of the results of the clustering of the basic colours is displayed in the dendrogram in Figure 6.12.

The extreme left of the dendrogram in Figure 6.12 shows the list of basic colours, along the y-axis, with their names and coded numbers and the distances at which the clusters of basic colours were formed using a 0 to 25 scale along the x-axis. The algorithm in hierarchical clustering starts with each basic colour, in a separate cluster and combines clusters until only one is left. Although the agglomeration schedule in Appendix K.4 provides a solution for 10 clusters, as it is seen in Figure 6.12, the dendrogram shows six clear clusters. Each basic colour is considered as one cluster and the other basic colours are added to previous three or four colours until only one cluster is left.

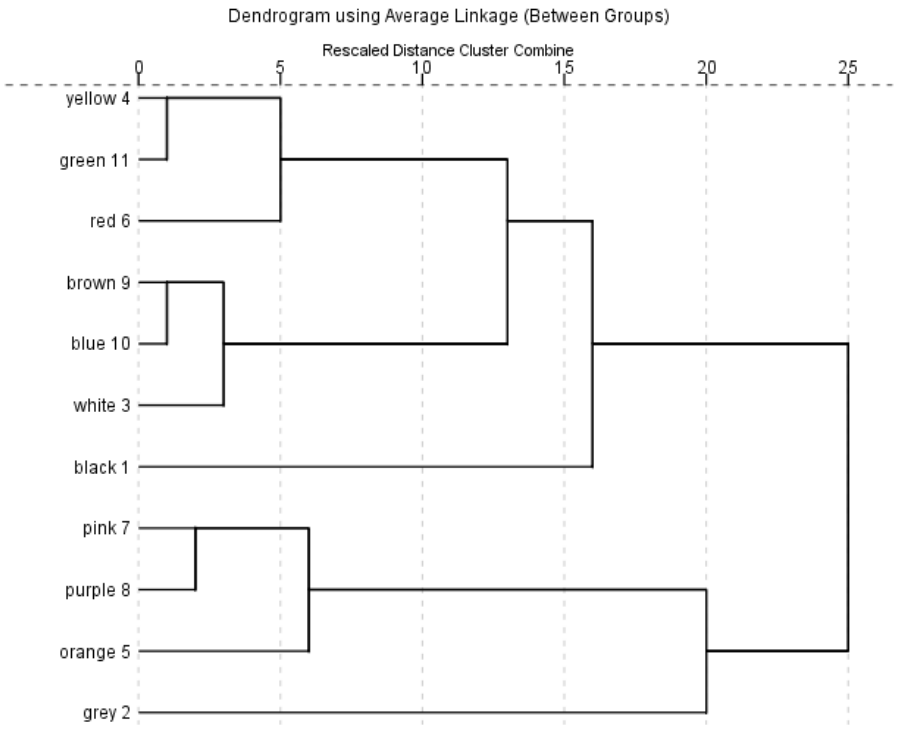


Figure 6.12 The dendrogram of the relationships among eleven basic colours within the *familiarity* factor

The first vertical lines in the dendrogram, corresponding to the smallest rescaled distance, are for the cluster combinations of the basic colours which are *yellow* (4) and *green* (11) in one group and *brown* (9) and *blue* (10) in another group. The next vertical line shows the cluster combinations of the basic colours *pink* (7) and *purple* (8) which are clustered together as at the larger distances than the other groups. As a result, within the *familiarity* factor, the strongest association in eleven basic colours are; i. *yellow* and *green*, ii. *brown* and *blue* and iii. *pink* and *purple*. The semantic differential charts in the following present the patterns of the basic colours among each group of cluster and their ratings on four attitudes in the *familiarity* factor.

Figure 6.13 presents the patterns of the ratings of the basic colours, i.e. *yellow* and *green*, on four attitudes in the semantic differential chart of the *familiarity* factor. In the chart, the vertical dotted line is used to show the midpoint, i.e. 4, of the 7-point rating scale running from 1 to 7. As it is seen,

yellow and *green* were rated more substantially by using the left poles more than the right poles of four attitudes. In other words, these colours were rated on the positive poles of the attitudes in the *familiarity* factor except the attitudes *familiar-unfamiliar* and *common-rare*. The participants rated *yellow* and *green* on these attitudes by considering them as neither *familiar* nor *unfamiliar* and neither *common* nor *rare*. As a result, these two colours were perceived as to have relatively identical ratings.

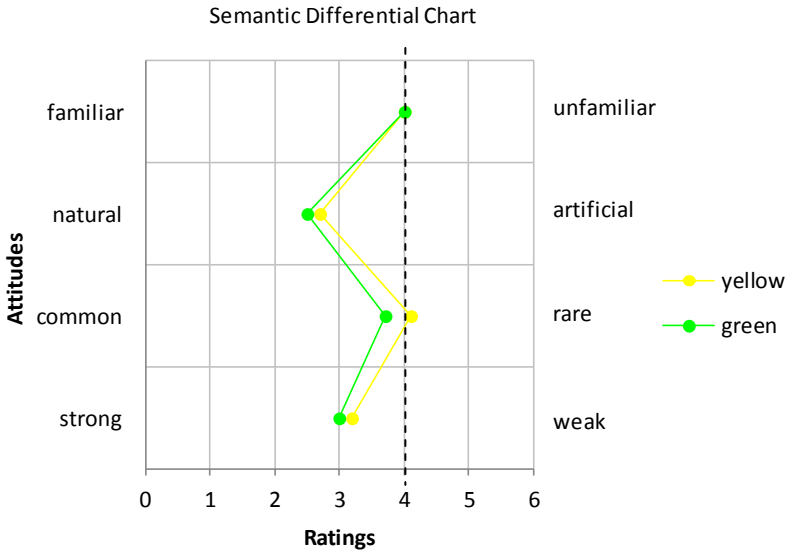


Figure 6.13 The patterns of the basic colours *yellow* and *green* within *familiarity* factor

Figure 6.14 presents the patterns of the ratings of the basic colours, i.e. *brown* and *blue*, on four attitudes in the semantic differential chart of the *familiarity* factor. In the chart, the vertical dotted line is used to show the midpoint, i.e. 4, of the 7-point rating scale.

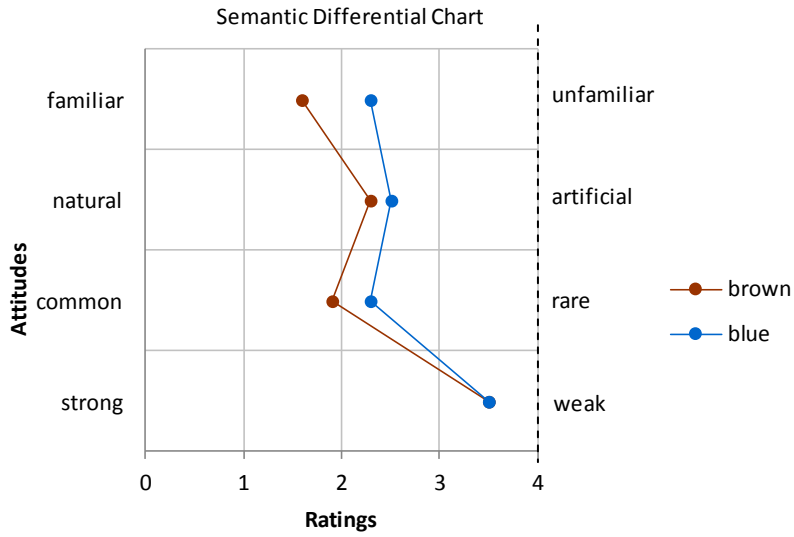


Figure 6.14 The patterns of the basic colours *brown* and *blue* within *familiarity* factor

As it is seen, *brown* and *blue* were rated more substantially by using the left poles more than the right poles of four attitudes. In other words, these colours were rated on the positive poles of the attitudes in the *familiarity* factor. Although there are relatively small differences of the patterns of the ratings of the two colours, they were perceived as to have nearly identical ratings. Additionally, *brown* and *blue* have some overlapping ratings on some of the attitudes, as well. For instance, as it is seen in the semantic differential chart, these two basic colours were rated as quite *natural* and slightly *strong*.

Figure 6.15 presents the patterns of the ratings of the basic colours, i.e. *pink* and *purple*, on four attitudes in the semantic differential chart of the *familiarity* factor. In the chart, the vertical dotted line is used to show the midpoint, i.e. 4, of the 7-point rating scale.

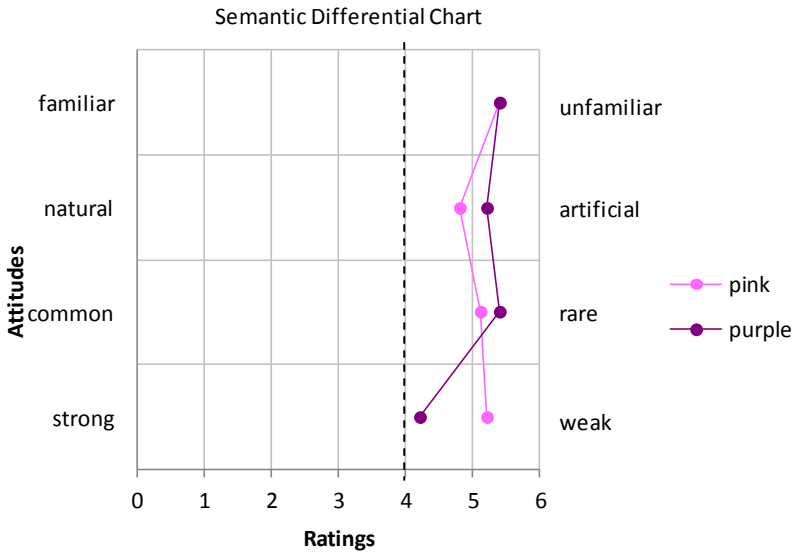


Figure 6.15 The patterns of the basic colours *pink* and *purple* within *familiarity* factor

As it is seen, *pink* and *purple* were rated more substantially by using the right poles more than the left poles of four attitudes. In other words, these colours were rated on the negative poles of the attitudes in the *familiarity* factor. In the semantic differential chart, two basic colours have some overlapping ratings on some of the attitudes. The participants rated *pink* and *purple* on the attitudes *familiar-unfamiliar* and *common-rare* by considering them as slightly *unfamiliar* and slightly *rare*. As a result, these two colours were perceived as to have relatively identical ratings.

6.2.3 One Sample T-Test: The Relationships between Eleven Basic Colours and the Common Attitudes within Each Four Factor

The *t-test* is a statistical test which is used to determine whether there is a significant difference between two or more groups of scores. The *one sample t-test* is one of the statistical tests from a relatively large number which is used to determine whether the obtained value is statistically different from the population mean. In other words, the one sample t-test is used in order to compare the mean of a sample with a population mean (i.e. test value) to determine whether the sample is significantly different. The sample mean is statistically significant when the p-value is less than 0.05 and 0.01 ($p < 0.05$ and $p < 0.01$) which means the confidence interval of the difference is hypothetically 95% and 99%, respectively (Larson-Hall, 2010).

Fransella et al. (2004) claim that, the t-tests have been demonstrated in practice to analyse the group differences in the repertory grid data. Therefore, in this research, one sample t-test was preferred to use for the two main purposes; i. it was used to determine which of the attitudes were perceived as significantly important by the participants over the other attitudes for each basic colour and ii. it was used to determine which of the poles of the attitudes were perceived as significant for the participants while they were construing and giving meaning to each basic colour. Consequently, one sample t-test was performed to investigate the relationships between eleven basic colours and the attitudes within each factor, i.e. *activity*, *lightness-purity*, *evaluation* and *familiarity*. The aim is to support general conclusions to determine the ways in which the participants construe and give meaning to eleven basic colours. The results are discussed in the following.

6.2.3.1 Results of One Sample T-Test between Eleven Basic Colours and the Common Attitudes within *Activity* Factor

The one sample t-test was computed to determine the most significant attitudes over the other attitudes within the *activity* factor and to reveal the attitude poles which were perceived as significant by the participants in construing and giving meaning to eleven basic colours. To this end, the mean score of each basic colour was compared with the overall mean score of 19 attitudes of each basic colour which was taken as the test value for the one sample t-test.

It is important to note that the overall mean score for 19 attitudes within the *activity* factor of each basic colour was different, therefore, each basic colour's test value varied. Since the purpose of one sample t-test was to compare means, the mean score of the attitude which was significantly below or above the overall mean score (i.e. test value) of each basic colour referred to which of the attitude pole of that attitude was significant in construing each basic colour. In other words, when the mean score of the attitude is significantly below the overall mean score, this indicates the left pole of that attitude is significant for that basic colour. Likewise when the mean score of the attitude which is significantly above the overall mean score, this indicates the right pole of that attitude is significant for that basic colour. For interpretation purposes, only the results of the significant attitudes (i.e. Sig. 2-tailed, $p < 0.05$ and $p < 0.01$) for each basic colour within the *activity* factor are presented in Table 6.15. The full results of one sample t-test for each basic colour can be found in Appendix L.1. The interpretations of one sample t-test in Table 6.13 are as follows.

Black. *Harmoniousness* (2,46) and *solemnness* (6,86) appear to be the most important attitudes in construing *black* because of being rated by the participants significantly below and above the overall mean score (4,43), respectively. *Sadness* (6,42), being *static* (6,29), being *inanimate* (6,21) and *passiveness* (6,00) follow solemnness in ranking. On the other hand, *dominancy* (2.48) and being *soothing* (3,08) follow harmoniousness in construing and perceiving *black*.

Grey. *Harmoniousness* (2,31) and being *inanimate* (6,57) appear to be the most important attitudes in construing *grey* because of being rated by the participants significantly below and above the overall mean score (5,52), respectively. *Inconspicuousness* (6,33), being *static* (6,29) and *dimness* (6,07) follow being inanimate in ranking. Being *soothing* (2,67) seems to be the next significant attitude towards *grey* because of being rated significantly below the overall mean score, as well.

White. *Harmoniousness* (2,46) and *calmness* (6,17) appear to be the most important attitudes in construing *white* because of being rated by the participants significantly below and above the overall mean score (4,28), respectively. *Brightness* (2,67) and being *soothing* (3,00) are the next significant attitudes following harmoniousness in ranking towards *white*.

Table 6.15 The results of one sample t-test for eleven basic colours within *activity* factor

Black :: Test Value: 4.83

Attitude	t	df	Sig. (2-tailed)	Mean
dynamic-static	3.18	20	0,000	6,29
active-passive	2,87	8	0,021	6,00
soothing-disturbing	-3,61	11	0,004	3,08
alive-inanimate	4,36	13	0,001	6,21
dominant-recessive	-5,22	20	0,000	2,48
cheerful-sad	5,07	11	0,000	6,42
harmonious-disharmonious	-5,55	25	0,000	2,46
frivolous-solemn	14,19	6	0,000	6,86

Grey :: Test Value: 5.52

Attitude	t	df	Sig. (2-tailed)	Mean
dynamic-static	3,18	20	0,005	6,29
conspicuous-inconspicuous	2,79	17	0,013	6,33
soothing-disturbing	-5,74	11	0,000	2,67
alive-inanimate	9,39	13	0,000	6,57
bright-dim	2,60	26	0,015	6,07
harmonious-disharmonious	-10,99	25	0,000	2,31

White :: Test Value: 4.28

Attitude	t	df	Sig. (2-tailed)	Mean
soothing-disturbing	-2,45	11	0,032	3,00
bright-dim	-4,56	26	0,000	2,67
harmonious-disharmonious	-6,07	25	0,000	2,12
aggressive-calm	3,48	5	0,018	6,17

Yellow :: Test Value: 2.73

Attitude	t	df	Sig. (2-tailed)	Mean
energetic-calm	-4,22	16	0,001	1,65
dynamic-static	-4,30	20	0,000	1,81
active-passive	-3,09	8	0,015	2,11
soothing-disturbing	10,44	11	0,000	5,83
alive-inanimate	-2,65	13	0,020	1,86
warm-cool	-2,36	19	0,029	2,20
cheerful-sad	-7,43	11	0,000	1,33
bright-dim	-4,94	26	0,000	1,81
harmonious-disharmonious	9,64	25	0,000	5,27

Orange :: Test Value: 2.34

Attitude	t	df	Sig. (2-tailed)	Mean
exciting-calming	-3,19	5	0,024	1,67
vivid-pale	-3,35	9	0,009	1,60
energetic-calm	-5,74	16	0,000	1,47
active-passive	-2,86	8	0,021	1,67
soothing-disturbing	7,43	11	0,000	5,25
alive-inanimate	-4,14	13	0,001	1,50
warm-cool	-3,47	19	0,003	1,80
entertaining-boring	-2,72	7	0,030	1,63
cheerful-sad	-2,63	11	0,023	1,67
harmonious-disharmonious	7,27	25	0,000	4,65
frivolous-solemn	-5,72	6	0,001	1,29

Red :: Test Value: 2.46

Attitude	t	df	Sig. (2-tailed)	Mean
vivid-pale	-7,59	9	0,000	1,30
energetic-calm	-2,59	16	0,020	1,94
dynamic-static	-2,33	20	0,030	1,90
conspicuous-inconspicuous	-3,58	17	0,002	1,78
soothing-disturbing	6,08	11	0,000	5,50
warm-cool	-9,84	19	0,000	1,25
dominant-recessive	-5,54	20	0,000	1,48
harmonious-disharmonious	4,21	25	0,000	4,15
frivolous-solemn	3,01	6	0,024	4,29
aggressive-calm	-5,34	5	0,003	1,33
expressive-unexpressive	-2,81	5	0,038	1,50

t-test yielded signficance ($p < 0.05$ and $p < 0.01$)

Table 6.15 (cont'd).

Pink :: Test Value: 4.23

Attitude	t	df	Sig. (2-tailed)	Mean
soothing-disturbing	-5,05	11	0,000	2,92
charming-charmless	-2,17	13	0,049	3,14
warm-cool	-2,65	19	0,016	3,45
cheerful-sad	-2,53	11	0,028	3,50
bright-dim	2,51	26	0,019	4,81
harmonious-disharmonious	2,84	25	0,009	4,88
frivolous-solemn	-7,23	6	0,000	2,00
aggressive-calm	3,41	5	0,019	5,67

Purple :: Test Value: 4.23

Attitude	t	df	Sig. (2-tailed)	Mean
dominant-recessive	-2,98	20	0,007	3,19
cheerful-sad	3,25	11	0,008	5,58
harmonious-disharmonious	2,16	25	0,041	4,77

Brown :: Test Value: 5.41

Attitude	t	df	Sig. (2-tailed)	Mean
active-passive	3,66	8	0,006	6,22
soothing-disturbing	-4,17	11	0,002	3,33
warm-cool	-3,01	19	0,007	4,40
entertaining-boring	8,19	7	0,000	6,75
bright-dim	5,62	26	0,000	6,22
harmonious-disharmonious	-3,85	25	0,001	4,08

Blue :: Test Value: 4.05

Attitude	t	df	Sig. (2-tailed)	Mean
energetic-calm	2,99	16	0,009	5,06
conspicuous-inconspicuous	-2,61	17	0,018	3,44
soothing-disturbing	-4,32	11	0,001	2,50
warm-cool	5,47	19	0,000	5,65
aggressive-calm	7,67	5	0,001	5,67
expressive-unexpressive	-3,03	5	0,029	2,83

Green :: Test Value: 3.02

Attitude	t	df	Sig. (2-tailed)	Mean
vivid-pale	-3,80	9	0,004	2,40
soothing-disturbing	2,80	11	0,017	4,50
alive-inanimate	-6,92	13	0,000	1,64
warm-cool	4,16	19	0,001	4,60
cheerful-sad	-2,65	11	0,023	2,17
bright-dim	-3,73	26	0,001	2,26
harmonious-disharmonious	6,44	25	0,000	4,65
frivolous-solemn	-4,57	6	0,004	1,71

t-test yielded signficance ($p < 0.05$ and $p < 0.01$)

Yellow. C*heerfulness* (1,33) and being *disturbing* (5,83) seem to be the most important attitudes in construing *yellow* because of being rated by the participants significantly below and above the overall mean score (2,73), respectively. *Disharmoniousness* (5,27) appears to be the next significant attitude in ranking towards *yellow* after being disturbing. Being *energetic* (1,65), *dynamism* (1,81) and *brightness* (1,81), *aliveness* (1,86), *activeness* (2,11) and *warmth* (2,20) follow cheerfulness in ranking which are rated significantly below the overall mean score.

Orange. *Frivolousness* (1,29) and being *disturbing* (5,25) seem to be the most important attitudes in perceiving *orange* because of being rated by the participants below and above the overall mean score (2,34), respectively. *Disharmoniousness* (4,65) appears to be the next significant attitude towards *orange* after being disturbing. Being *energetic* (1,47), *aliveness* (1,50), *vividness* (1,60), being *entertaining* (1,63), *excitingness* (1,67), *activeness* (1,67), *cheerfulness* (1,67) and *warmth* (1,80) follow frivolousness in ranking.

Red. *Warmth* (1,25) and being *disturbing* (5,50) appear to be the most important attitudes in construing *red* because of being rated by the participants below and above the overall mean score (2,46), respectively. *Solemnness* (4,29) and *disharmoniousness* (4,15) follow being disturbing in ranking. On the other hand, *vividness* (1,30), *aggressiveness* (1,33), *dominancy* (1,48), *expressiveness* (1,50), *conspicuousness* (1,78), *dynamism* (1,90) and being *energetic* (1,94) follow warmth in perceiving and construing *red*.

Pink. *Frivolousness* (2,00) and *calmness* (5,67) appear to be the most important attitudes in construing *pink* because of being rated by the participants below and above the overall mean score (4,23), respectively. *Disharmoniousness* (4,88) and *dimness* (4,81) follow calmness in ranking. Being *soothing* (2,92), being *charming* (3,14), *warmth* (3,45) and *cheerfulness* (3,50) are the other significant attitudes towards *pink* because of being rated significantly below the overall mean score.

Purple. *Dominancy* (3,19) and *sadness* (5,58) appear to be the most important attitudes in perceiving *purple* because of being rated by the participants below and above the overall mean score (4,23), respectively. *Disharmoniousness* (4,77) seems to be the next important attitude towards *purple* after sadness because of being rated above the overall mean score.

Brown. Being *soothing* (3,33) and being *boring* (6,75) appear to be the most important attitudes in construing *brown* because of being rated by the participants below and above the overall mean score (5,41), respectively. *Passiveness* (6,22) and *dimness* (6,22) follow being boring in ranking. *Harmoniousness* (4,08) and *warmth* (4,40) seem to be the next significant attitudes in ranking towards *brown* after being soothing.

Blue. Being *soothing* (2,50) and *calmness* (opposite of *aggressiveness*) (5,67) appear to be the most important attitudes in construing *blue* because of being rated by the participants below and above the overall mean score (4,05), respectively. *Coolness* (5,65) and *calmness* (opposite of being *energetic*) (5,06) follow calmness in ranking. On the other hand, *expressiveness* (2,83) and *conspicuousness* (3,44) follow being soothing in construing and perceiving *blue*.

Green. *Aliveness* (1,64) and *disharmoniousness* (4,65) appear to be the most important attitudes in construing *green* because of being rated by the participants below and above the overall mean score (3,02), respectively. *Coolness* (4,60) and being *disturbing* (4,50) follow disharmoniousness in ranking. *Frivolousness* (1,71), *cheerfulness* (2,17), *brightness* (2,26) and *vividness* (2,40) seem to be the other important attitudes towards *green* because of being rated significantly below the overall mean score.

Table 6.16 The summary of the participants' ways of construing eleven basic colours within *activity* factor

Black	Grey	White	Yellow	Orange	Red	Pink	Purple	Brown	Blue	Green
					Attitude (+)					
harmonious	harmonious	harmonious	cheerful	frivolous	warm	frivolous	dominant	soothing	soothing	alive
dominant	soothing	bright	energetic	energetic	vivid	soothing		harmonious	expressive	frivolous
soothing		soothing	dynamic	alive	aggressive	charming		warm	conspicuous	cheerful
			bright	vivid	dominant	warm				bright
			alive	entertaining	expressive	cheerful				vivid
			active	exciting	conspicuous					
			warm	active	dynamic					
				cheerful	energetic					
				warm						
					Attitude (-)					
solemn	inanimate	calm*	disturbing	disturbing	disturbing	calm*	sad	boring	calm*	disharmonious
sad	inconspicuous		disharmonious	disharmonious	solemn	disharmonious	disharmonious	passive	cool	cool
static	static				disharmonious	dim		dim	calm†	disturbing
inanimate	dim									
passive										

* opposite of aggressive

† opposite of energetic

Table 6.16 summaries the ways in which the participants construed and gave meaning to eleven basic colours within the *activity* factor. In other words, it presents the relationships between eleven basic colours and the attitudes within the *activity* factor. They are listed in order of statistical significance in terms of the attitude poles. For reminding purposes, the left poles of the attitudes were considered as positive poles, whereas, the right poles of the attitudes were considered as negative poles (see Section 5.1.3.1).

6.2.3.2 The Results of One Sample T-Test between Eleven Basic Colours and the Attitudes within *Lightness-Purity* Factor

The one sample t-test was computed to determine the most significant attitudes over the other attitudes within the *lightness-purity* factor and to reveal the attitude poles which were perceived as significant by the participants in construing and giving meaning to eleven basic colours. To this end, the mean score of each basic colour was compared with the overall mean score of 15 attitudes of each basic colour which was taken as the test value for the one sample t-test.

Again, it is important to note that the overall mean score for 15 attitudes within the *lightness-purity* factor of each basic colour was different, therefore, each basic colour's test value varied. The mean score of the attitude which was significantly below or above the overall mean score (i.e. test value) of each basic colour referred to which of the attitude pole of that attitude was significant in construing each basic colour. In other words, when the mean score of the attitude is significantly below the overall mean score, this indicates the left pole of that attitude is significant for that basic colour. Likewise when and the mean score of the attitude is significantly above the overall mean score, this indicates the right pole of that attitude is significant for that basic colour. For interpretation purposes, only the results of the significant attitudes (i.e. Sig. 2-tailed, $p < 0.05$ and $p < 0.01$) for each basic colour within the *lightness-purity* factor are presented in Table 6.17. The full results of the one sample t-test for each basic colour can be found in Appendix I.2. The interpretations of the one sample t-test in Table 6.17 are as follows.

Black. *Heaviness* (1,00) and *darkness* (opposite of *lightness*) (7,00) appear to be the most important attitudes in construing *black* because of being rated by the participants significantly below and above the overall mean score (4,95), respectively. *Darkness* (opposite of *luminosity*) (6,81), *gloominess* (6,64), *suffocation* (6,43) and *negativity* (6,00) seem to be the following important attitudes in ranking towards *black* after darkness. On the other hand, *maturity* (1,07) and *hardness* (1,10) follow heaviness in construing and perceiving *black* because of being rated below the overall mean score.

Grey. *Maturity* (2,13) and *gloominess* (5,82) appear to be the most important attitudes in construing *grey* because of being rated by the participants significantly below and above the overall mean score (4,48), respectively. *Dirtiness* (5,58) and *pessimism* (5,56) follow gloominess in ranking. *Clearness* (3,00) and *lightness* (opposite of darkness) (3,92) seem to be the next significant attitudes in ranking after maturity towards *grey*.

White. Being *innocent* (1,00) and *cleanliness* (1,00), and *lightness* (opposite of *heaviness*) (6,67) appear to be the most important attitudes in construing *white* because of being rated by the participants significantly below and above the overall mean score (2,43). *Softness* (5,60) and *immaturity* (4,00) follow lightness in ranking. *Lightness* (opposite of *darkness*) (1,04), *luminosity* (1,19), *clearness* (1,20), *purity* (1,33) and being *refreshing* (1,43) seem to be the other important attitudes towards *white* because of being rated significantly below the overall mean score.

Table 6.17 The results of one sample t-test for eleven basic colours within *lightness-purity* factor

Black :: Test Value: 4.95

Attitude	t	df	Sig. (2-tailed)	Mean
heavy-light	a	8	0,000	1,00
refreshing-suffocating	3,45	6	0,014	6,43
light-dark	a	23	0,000	7,00
luminous-dark	9,93	15	0,000	6,81
positive-negative	2,38	8	0,044	6,00
hard-soft	-38,50	9	0,000	1,10
cheering-gloomy	8,30	10	0,000	6,64
mature-immature	-58,25	14	0,000	1,07

a. t cannot be computed because the standard deviation is 0.

Grey :: Test Value: 4.48

Attitude	t	df	Sig. (2-tailed)	Mean
light-dark	-2,35	23	0,028	3,92
clean-dirty	3,08	11	0,010	5,58
clear-complex	-4,68	4	0,009	3,00
optimistic-pessimistic	2,61	8	0,031	5,56
cheering-gloomy	3,55	10	0,005	5,82
mature-immature	-9,18	14	0,000	2,13

White :: Test Value: 2.43

Attitude	t	df	Sig. (2-tailed)	Mean
heavy-light	25,42	8	0,000	6,67
refreshing-suffocating	-3,37	6	0,015	1,43
innocent-malicious	a	4	0,000	1,00
light-dark	-33,32	23	0,000	1,04
pure-impure	-5,20	5	0,003	1,33
luminous-dark	-6,63	15	0,000	1,19
clean-dirty	a	11	0,000	1,00
hard-soft	6,09	9	0,000	5,60
clear-complex	-6,15	4	0,004	1,20
mature-immature	3,22	14	0,006	4,00

a. t cannot be computed because the standard deviation is 0.

Yellow :: Test Value: 3.10

Attitude	t	df	Sig. (2-tailed)	Mean
heavy-light	5,72	8	0,000	5,11
innocent-malicious	-2,86	4	0,046	2,40
light-dark	-5,90	23	0,000	2,33
optimistic-pessimistic	-3,92	8	0,004	1,89
cheering-gloomy	-6,65	10	0,000	1,45
mature-immature	7,92	14	0,000	5,80

Orange :: Test Value: 3.55

Attitude	t	df	Sig. (2-tailed)	Mean
innocent-malicious	-3,61	4	0,023	2,20
clean-dirty	-3,20	11	0,008	2,75
positive-negative	-2,76	8	0,025	2,33
cheering-gloomy	-10,09	10	0,000	1,91
mature-immature	10,91	14	0,000	6,20

Red :: Test Value: 4.02

Attitude	t	df	Sig. (2-tailed)	Mean
heavy-light	-3,82	8	0,005	2,44
light-dark	4,42	23	0,000	4,88
restful-restless	4,94	5	0,004	5,67
hard-soft	-5,73	9	0,000	2,30
optimistic-pessimistic	-2,38	8	0,045	3,44

t-test yielded signficance ($p < 0.05$ and $p < 0.01$)

Table 6.17 (cont'd).

Pink :: Test Value: 3.48

Attitude	t	df	Sig. (2-tailed)	Mean
heavy-light	13,14	8	0,000	6,11
innocent-malicious	-11,40	4	0,000	1,20
light-dark	-6,88	23	0,000	2,33
luminous-dark	-3,39	15	0,004	2,50
restful-restless	-2,72	5	0,042	2,33
positive-negative	-2,53	8	0,035	2,78
hard-soft	18,12	9	0,000	6,50
optimistic-pessimistic	-2,45	8	0,040	2,56
mature-immature	10,91	14	0,000	6,47

Purple :: Test Value: 4.71

Attitude	t	df	Sig. (2-tailed)	Mean
heavy-light	-5,48	8	0,001	2,67
light-dark	3,95	23	0,001	5,38
clear-complex	4,08	4	0,015	6,00
mature-immature	-2,73	14	0,016	3,73

Brown :: Test Value: 4.83

Attitude	t	df	Sig. (2-tailed)	Mean
heavy-light	-13,42	8	0,000	1,67
refreshing-suffocating	3,10	6	0,021	5,71
light-dark	9,54	23	0,000	5,88
luminous-dark	3,27	15	0,005	5,75
clean-dirty	2,48	11	0,031	5,83
hard-soft	-3,43	9	0,008	3,10
clear-complex	3,66	4	0,022	6,20
cheering-gloomy	3,88	10	0,003	6,00
mature-immature	-10,04	14	0,000	2,20

Blue :: Test Value: 3.51

Attitude	t	df	Sig. (2-tailed)	Mean
heavy-light	2,48	8	0,038	4,44
light-dark	5,63	23	0,000	4,67
mature-immature	3,05	14	0,009	4,33

Green :: Test Value: 3.24

Attitude	t	df	Sig. (2-tailed)	Mean
heavy-light	4,28	8	0,003	4,67
refreshing-suffocating	-3,31	6	0,016	2,57
pure-impure	-4,30	5	0,008	2,33
positive-negative	-2,79	8	0,023	2,22
optimistic-pessimistic	-3,65	8	0,006	2,11
cheering-gloomy	-3,14	10	0,010	2,36
mature-immature	6,51	14	0,000	5,60

t-test yielded signficance ($p < 0.05$ and $p < 0.01$)

Yellow. Being *cheering* (1,45) and *immaturity* (5,80) appear to be the most important attitudes in construing *yellow* because of being rated by the participants significantly below and above the overall mean score (3,10), respectively. *Lightness* (opposite of *heaviness*) (5,11) seem to be next significant attitude in perceiving *yellow* after immaturity. *Optimism* (1,89), *lightness* (opposite of *darkness*) (2,33) and being *innocent* (2,40) follow being cheering in ranking.

Orange. Being *cheering* (1,91) and *immaturity* (6,20) appear to be the most important attitudes in construing *orange* because of being rated by the participants significantly below and above the overall mean score (3,55), respectively. Being *innocent* (2,20), *positivity* (2,33) and *cleanness* (2,75) seem to be the next significant attitudes in ranking towards *orange*.

Red. *Hardness* (2,30) and *restlessness* (5,67) appear to be the most important attitudes in construing *red* because of being rated by the participants significantly below and above the overall mean score (4,02), respectively. *Darkness* (opposite of *lightness*) (4,88) follows restlessness in ranking. *Heaviness* (2,44) and *optimism* (3,44) seem to be next significant attitudes in perceiving *red* in ranking.

Pink. Being *innocent* (1,20) and *softness* (6,50) appear to be the most important attitudes in construing *pink* because of being rated by the participants significantly below and above the overall mean score (3,48), respectively. *Immaturity* (6,47) seem to be the next significant attitude towards *pink* after softness. *Lightness* (opposite of *darkness*) (2,33) and *restfulness* (2,33), *luminosity* (2,50), *optimism* (2,56) and *positivity* (2,78) follow being innocent in ranking.

Purple. *Heaviness* (2,67) and *complexity* (6,00) appear to be the most important attitudes in construing *purple* because of being rated by the participants significantly below and above the overall mean score (4,71), respectively. *Maturity* (3,73) and d*arkness* (opposite of *lightness*) (5,38) seem to be the next significant attitudes towards *purple* in ranking.

Brown. *Heaviness* (1,67) and *complexity* (6,20) seem to be the most important attitudes in construing *brown* because of being rated by the participants significantly below and above the overall mean score (4,83), respectively. *Gloominess* (6,00), *darkness* (opposite of *lightness*) (5,88), *dirtiness* (5,83) *darkness* (opposite of *luminosity*) (5,75) and *suffocation* (5,71) follow complexity in ranking. *Maturity* (2,20) and *hardness* (3,10) seem to be the next significant attitudes in ranking towards *brown* after heaviness.

Blue. *Darkness* (opposite of *lightness*) (4,67) appear to be the most important attitude in construing *blue* because of being rated by the participants significantly above the overall mean score (3,51). *Immaturity* (4,33) and *lightness* (opposite of heaviness) (4,44) seem to be next significant attitudes in ranking towards *blue* after darkness.

Green. *Optimism* (2,11) and *immaturity* (5,60) appear to be the most important attitudes in construing *green* because of being rated by the participants significantly below and above the overall mean score (3,24), respectively. *Lightness* (opposite of *heaviness*) (4,67) follow immaturity in ranking. *Positivity* (2,33), *purity* (2,33), being *cheering* (2,36) and being *refreshing* (2,57) seem to be the other significant attitudes towards *green* because of being rated significantly below the overall mean score.

Table 6.18 summaries the ways in which the participants construed and gave meaning to eleven basic colours within the *lightness-purity* factor. In other words, it presents the relationships between eleven basic colours and the attitudes within the *lightness-purity* factor. They are listed order of statistical significance in terms of the attitude poles. For reminding purposes, the left poles of the attitudes were considered as positive poles, whereas, the right poles of the attitudes were considered as negative poles (see Section 5.1.3.1).

Table 6.18 The summary of the participants' ways of construing eleven basic colours within *lightness-purity* factor

Black	Grey	White	Yellow	Orange	Red	Pink	Purple	Brown	Blue	Green
					Attitude (+)					
heavy	mature	innocent	cheering	cheering	hard	innocent	heavy	heavy		optimistic
mature	clear	clean	optimistic	innocent	heavy	light[a]	mature	mature		positive
hard	light[a]	light[a]	light[a]	positive	optimistic	restful		hard		pure
		luminous	innocent	clean		luminous				cheering
		clear				optimistic				refreshing
		pure				positive				
		refreshing								
					Attitude (-)					
dark*	gloomy	light[b]	immature	immature	restless	soft	complex	complex	dark	immature
dark†	dirty	soft	light[b]		dark*	immature	dark*	gloomy	immature	light[b]
gloomy	pessimistic	immature						dark*	light[b]	
suffocating										
negative										

* opposite of light
† opposite of luminous
[a] opposite of dark
[b] opposite of heavy

6.2.3.3 The Results of One Sample T-Test between Eleven Basic Colours and the Attitudes within *Evaluation* Factor

The one sample t-test was computed to determine the most significant attitudes over the other attitudes within the *evaluation* factor and to reveal the attitude poles which were perceived as significant by the participants in construing and giving meaning to eleven basic colours. To this end, the mean score of each basic colour was compared with the overall mean score of three attitudes of each basic colour which was taken as the test value for the one sample t-test.

Again, it is important to note that the overall mean score for three attitudes within the *evaluation* factor of each basic colour was different; therefore, each basic colour's test value differed. The mean score of the attitude which was significantly below or above the overall mean score (i.e. test value) of each basic colour referred to which of the attitude pole of that attitude was significant in construing each basic colour. In other words, when the mean score of the attitude is significantly below the overall mean score, this indicates the left pole of that attitude is significant for that basic colour. Likewise when the mean score of the attitude is significantly above the overall mean score, this indicates the right pole of that attitude is significant for that basic colour. For interpretation purposes, only the results of the significant attitudes (i.e. Sig. 2-tailed, $p < 0.05$ and $p < 0.01$) for each basic colour within the *evaluation* factor are presented in Table 6.19.

Table 6.19 The results of one sample t-test for eleven basic colours within *evaluation* factor

	Grey :: Test Value: 2.43					**Red** :: Test Value: 3.13			
Attitude	t	df	Sig. (2-tailed)	Mean	**Attitude**	t	df	Sig. (2-tailed)	Mean
attractive-repulsive	5,62	13	0,000	5,00	attractive-repulsive	-2,88	13	0,013	2,00

As it is seen in Table 6.19, only the mean scores of two out of eleven basic colours are statistically significant ($p < 0.05$ and $p < 0.01$) within the attitudes of the *evaluation* factor. The full results of the one sample t-test for each basic colour can be found in Appendix K.3. The mean scores of other basic colours besides two of them are not significant because their p-values are more than 0.05 ($p > 0.05$). This means that the confidence interval of the difference of these basic colours is not 95%.

In accordance, the results of the t-test indicate that *repulsiveness* (5,00) of ***grey*** and *attractiveness* (2,00) of ***red*** appear to be the most important attitudes in construing these basic colours because of being rated by the participants significantly below the overall mean score (2,43) and above the overall mean score (3,13), respectively.

6.2.3.4 The Results of One Sample T-Test between Eleven Basic Colours and the Attitudes within *Familiarity* Factor

The one sample t-test was computed to determine the most significant attitudes over the other attitudes within the *familiarity* factor and to reveal the attitude poles which were perceived as significant by the participants in construing and giving meaning to eleven basic colours. To this end, the mean score of each basic colour was compared with the overall mean score of four attitudes of each basic colour which was taken as the test value for the one sample t-test.

Again, it is important to note that the overall mean score for four attitudes within the *familiarity* factor of each basic colour was different; therefore, each basic colour's test value differed. The mean score of the attitude which was significantly below or above the overall mean score (i.e. test value)

of each basic colour referred to which of the attitude pole of that attitude was significant in construing each basic colour. This means that when the mean score of the attitude is significantly below the overall mean score, this indicates the left pole of that attitude is significant for that basic colour. Likewise when the mean score of the attitude is significantly above the overall mean score, this indicates the right pole of that attitude is significant for that basic colour. For interpretation purposes, only the results of the significant attitudes (i.e. Sig. 2-tailed, $p < 0.05$ and $p < 0.01$) for each basic colour within the *familiarity* factor are presented in Table 6.18.

As it is seen in Table 6.18, only the mean scores of six out of eleven basic colours are statistically significant ($p < 0.05$ and $p < 0.01$) within the attitudes of the *familiarity* factor. The full results of the one sample t-test for each basic colour can be found in Appendix K.4. The mean scores of basic colours besides six of them are not significant because their p-values are more than 0.05 ($p > 0.05$). This means that the confidence interval of the differences of these basic colours is not 95%. The interpretations of the results of the one sample t-test of six basic colours in Table 6.20 are as follows.

Table 6.20 The results of one sample t-test for eleven basic colours within *familiarity* factor

Black :: Test Value: 2.78

Attitude	t	df	Sig. (2-tailed)	Mean
natural-artificial	4,23	31	0,000	4,50
strong-weak	-9,68	5	0,000	1,17

Grey :: Test Value: 3.95

Attitude	t	df	Sig. (2-tailed)	Mean
natural-artificial	3,54	31	0,001	5,13

Yellow :: Test Value: 3.50

Attitude	t	df	Sig. (2-tailed)	Mean
natural-artificial	-2,53	31	0,017	2,72

Red :: Test Value: 3.23

Attitude	t	df	Sig. (2-tailed)	Mean
strong-weak	-4,69	5	0,005	1,67

Brown :: Test Value: 2.33

Attitude	t	df	Sig. (2-tailed)	Mean
familiar-unfamiliar	-2,68	7	0,032	1,63

Green :: Test Value: 3.30

Attitude	t	df	Sig. (2-tailed)	Mean
natural-artificial	-2,54	31	0,016	2,47

Black. *Strength* (1,17) and *artificiality* (4,50) appear to be the most important attitudes in construing *black* because of being rated by the participants significantly below and above the overall mean score (2,78), respectively.

Grey. *Artificiality* (5,13) seems to be the most important attitude in construing *grey* because of being rated by the participants significantly above the overall mean score (3,95).

Yellow. *Naturalness* (2,72 seems to be the most important attitude in construing *yellow* because of being rated by the participants significantly below the overall mean score (3,50).

Red. *Strength* (1,67) appears to be the most important attitude in construing *red* because of being rated by the participants significantly below the overall mean score (3,23).

Brown. *Familiarity* (1,63) appears to be the most important attitude in construing brown because of being rated by the participants significantly below the overall mean score (2,33).

Green. *Naturalness* (2,47) seems to be the most important attitude in construing *green* because of being rated by the participants significantly below the overall mean score (3,30).

Table 6.21 summaries the ways in which the participants construed and gave meaning to eleven basic colours within the *familiarity* factor. In other words, it presents the relationships between eleven basic colours and the attitudes within the *familiarity* factor. They are listed order of statistical significance in terms of the attitude poles. For reminding purposes, the left poles of the attitudes were considered as positive poles, whereas, the right poles of the attitudes were considered as negative poles (see Section 5.1.3.1).

Table 6.21 The summary of the participants' ways of construing eleven basic colours within *familiarity* factor

Black	**Grey**	**Yellow**	**Red**	**Brown**	**Green**
		Attitude (+)			
strong		natural	strong	familiar	natural
		Attitude (-)			
artificial	artificial				

6.2.4 The Relationships between Eleven Basic Colours and Four Factors

The one sample t-test was conducted in order to compare the mean of each basic colour within each factor with the population mean (i.e. test value) of each basic colour in a total of 41 attitudes. The purpose was to determine which of the basic colour(s) over other basic colours were significant among the four factors; i.e. *activity*, *lightness-purity*, *evaluation* and *familiarity*. The mean scores of the basic colours are statistically significant when the p-value is less than 0.05 and 0.01 ($p < 0.05$ and $p < 0.01$) which means the confidence interval of the difference is hypothetically 95% and 99%, respectively.

It is important to note that, the overall mean score of 41 attitudes of each basic colour was different; therefore each basic colour's test value was different, as well. The results of the t-test are presented in Table 6.22 and the bold items show the basic colours which are significantly below and above the overall mean score of each basic colour among the four factors. In other words, when the mean score of each basic colour in each factor score significantly below the overall mean score of each basic colour, this designates that the corresponding factor is positively significant with that basic colour. On the other hand, when the mean score of each basic colour in each factor score significantly above the overall mean score of each basic colour, this indicates that the corresponding factor is negatively significant with that basic colour. The interpretations of the one sample t-test in Table 6.22 are as follows;

Activity Factor. *Grey* (5,52), *white* (4,28) and *brown* (5,41) are related significantly negative with the *activity* factor because their mean scores are above the overall mean scores, i.e. 4,86, 3,41 and 4,94 respectively. This indicates that these basic colours were construed and perceived as significantly with the negative poles in this factor. As the results of the t-test show, being *inanimate* of *grey*, *calmness* of *white* and being *boring* of *brown* appear to be the most important attitudes in construing and perceiving these colours (see Section 6.2.3.1). *Orange* (2,34) and *red* (2,46), on the other hand, are related significantly positive with the *activity* factor because their mean scores, i.e. 3,04 and 3,15 respectively, are below the overall mean scores. This designates that these basic colours were construed and perceived as significantly with the positive poles. As the results of t-test indicate, *frivolousness* of *orange* and *warmth* of *red* seem to be the most significant attitudes in perceiving and construing these colours (Section 6.2.3.1).

Table 6.22 The results of one sample t-test for eleven basic colours among four factors

	Factor															
	Activity				Lightness-Purity				Evaluation				Usualness			
Eleven Basic Colours	t	df	Sig. (2-tailed)	Mean	t	df	Sig. (2-tailed)	Mean	t	df	Sig. (2-tailed)	Mean	t	df	Sig. (2-tailed)	Mean
Black :: Test Value: 4.56	0,853	18	0,405	4,83	0,720	14	0,483	4,95	-15,043	2	**0,004****	3,23	-2,486	3	0,089	2,78
Grey :: Test Value. 4.86	2,560	18	**0,020***	5,52	-1,511	14	0,153	4,48	-1,546	2	0,262	3,83	-1,286	3	0,289	3,95
White :: Test Value: 3.41	3,691	18	**0,002****	4,28	-2,133	14	0,051	2,43	-0,720	2	0,546	3,30	-0,983	3	0,398	3,05
Yellow :: Test Value: 3.04	-1,087	18	0,292	2,73	0,177	14	0,862	3,10	4,212	2	0,052	4,10	1,377	3	0,262	3,50
Orange :: Test Value: 3.04	-2,748	18	**0,013***	2,34	1,676	14	0,116	3,55	4,503	2	**0,046***	3,30	3,581	3	**0,037***	4,28
Red :: Test Value: 3.15	-2,462	18	**0,024***	2,46	3,493	14	**0,004****	4,02	-0,022	2	0,985	3,13	0,137	3	0,900	3,23
Pink :: Test Value: 4.10	0,624	18	0,540	4,23	-1,412	14	0,180	3,48	3,897	2	0,060	5,00	8,200	3	**0,004****	5,13
Purple :: Test Value: 4.45	-1,403	18	0,178	4,23	1,225	14	0,241	4,71	-5,963	2	**0,027***	3,73	2,089	3	0,128	5,05
Brown :: Test Value: 4.94	2,485	18	**0,023***	5,41	-0,311	14	0,760	4,83	6,388	2	**0,024***	6,07	-6,270	3	**0,008****	2,33
Blue :: Test Value: 3.71	1,752	18	0,097	4,05	-1,041	14	0,315	3,51	0,769	2	0,523	3,93	-3,690	3	**0,035***	2,65
Green :: Test Value: 3.14	-0,508	18	0,618	3,02	0,369	14	0,717	3,24	-0,050	2	0,965	3,13	0,472	3	0,669	3,30

t-test yielded significance (*p < 0.05 and **p < 0.01), p value in bold.

Lightness-Purity Factor. Only *red* has a significant difference over the other basic colours. It is related significantly negative because its mean score (4,02) is above the overall mean score, i.e. 3,15. This describes that *red* was perceived as significantly with the negative poles of the attitudes in the *lightness-purity* factor. As the results of t-test show, *restlessness* appears to be the most important attitude in construing *red* (see Section 6.2.3.2).

Evaluation Factor. *Black* (3,23), *orange* (3,30) and *purple* (3,73) are related significantly positive with the *evaluation* factor because their mean scores are below the overall mean scores, i.e. 4,56, 3,04 and 4,45, respectively. This means that these basic colours were construed as significantly with the positive pole in this factor. *Brown* (6,07), on the other hand, is related significantly negative because its mean score is above the overall mean score, i.e. 4,94. This indicates that *brown* was perceived as significantly with the negative poles of the attitudes. No significant differences between these basic colours over the other basic colours were revealed as the result of the t-test that was conducted within the attitudes of the *evaluation* factor (see Section 6.2.3.3).

Familiarity Factor. *Orange*, *pink*, *brown* and *blue* have significant differences over the other basic colours. *Brown* (2,33) and *blue* (2,65) are related significantly positive with the *familiarity* factor because their mean scores are below their overall mean scores, i.e. 4,94 and 3,71, respectively. This designates that these basic colours were construed and perceived as significantly with the positive poles of the attitudes in the *familiarity* factor. As the results of t-test show, *familiarity* appears to be the most important attitude in construing *brown*; however, *blue* has no significant difference (see Section 6.2.3.2). *Orange* (4,28) and *pink* (5,13) are related significantly negative with the *familiarity* factor because their mean scores are above the overall mean score, i.e. 3,04 and 4,10, respectively. This indicates that these basic colours were perceived and construed as significantly with the negative poles of the attitudes of this factor. The results of the t-test showed that, they have no significant differences over the other basic colours.

Table 6.23 summaries the relationships between the eleven basic colours and the four factors. Positive and negative relations of each factor among eleven basic colours are presented by a plus sign (i.e. '+') and a minus sign (i.e. '-'), respectively. As indicated by Table 6.23, while *orange* and *red* have significant positive relations, *grey*, *white* and *brown* have significant negative relations with the *activity* factor. *Black* and *purple* have significant positive relations with the *evaluation* factor, whereas, *orange* and *brown* have significant negative relations with the *evaluation* factor. In the *familiarity* factor, while *blue* and *brown* have significant positive relations, *orange* and *pink* have significant negative relations. *Red* has a significant negative relation with the *lightness-purity* factor. *Yellow* and *green* have no significant relations either positively or negatively with any of the factors.

Table 6.23 The summary of the relationships between eleven basic colours and four factors

Black	Grey	White	Yellow	Orange	Red	Pink	Purple	Brown	Blue	Green
Factor										
Evaluation (+)	Activity (-)	Activity (-)		Activity (+) Evaluation (-) Usualness (-)	Activity (+) Lightness- Purity (-)	Usualness (-)	Evaluation (+)	Activity (-) Evaluation (-) Usualness (+)	Usualness (+)	

CHAPTER 7

CONCLUSION

The major aim of this thesis was to explore the attitudinal approaches of individuals towards perceived colours. Thus, the research addressed two main questions:

1. How do individuals think of/give meanings to/construe the perceived colours in their own words?

2. How are individuals' attitudes and the perceived colours related?

In order to find the answers of the above mentioned questions, the research intended as a first step towards eliciting the idiosyncratic/personal attitudes of individuals towards perceived colours by utilising the Repertory Grid Technique (RGT). This was done by eliciting firstly the personal attitudes of each individual in construing the perceived colours in his/her own words and then investigating the interpersonal relations of the common attitudes that the individuals mostly verbalise. As a second step the research intended to explore the structure and the interrelations between the common elicited attitudes and the perceived colours. This was done by examining firstly the underlying factors of the common attitudes and their relatedness among the perceived colours, and then investigating the relationship between the common attitudes and the perceived colours.

The research was particularly based on data-driven approaches because it aimed at exploring these aforementioned objectives. Therefore, this made the research an explorative study. However, the research included the application of experimental research type because of the elicited data resulting from the planned experiment. This indicated that the researcher manipulated the independent and dependent variables under highly controlled conditions in order to explore the cause and effect relationships between them. Subsequently, the research was about the independent variables, i.e. the perceived colours, and the results of the research were the dependent variables, i.e. the elicited idiosyncratic/personal attitudes of the individuals. Experimental research type studies are primarily nomothetic and quantitative, whereas the applied method which was the RGT is idiographic in nature. However, the RGT included the applications of both qualitative and quantitative research perspectives because it was based on the quantifying the qualitative insights of the individuals' idiosyncratic/personal attitudes. Hence, the research was undertaken as the mixture of both research perspectives, i.e. both qualitative and quantitative, throughout the course of the experiment.

The experiment was conducted in an office in Middle East Technical University (METU) Faculty of Architecture and carried out with the utilisation of the viewing cabinet that was situated within this experiment room. The main purpose for using a viewing cabinet was to create a reliable viewing condition for colours to be perceived under a consistent light. The reason for this was that the experiment room was facing east. Daily and seasonal movements of the sun on this façade produce discomfort shadows, patterns and glares which might cause to perceive colours differently. Therefore, the window of the experiment room was blinded to block the natural light. This was to control daylight and create a darkened room. The illumination of the experiment room was provided only with the utilisation of this viewing cabinet. The viewing cabinet was in the form of rectangular prism which consisted of five uniform grey of L^* of 50 backgrounds and illuminated by a D65 simulator from the top. A portable colour holder display in 45° angle to the light source was also used to minimise glare of the colours that were presented in the cabinet during the experiment.

The perceived colours that were used as stimuli in the experiment were eleven basic colour categories. These colours are considered as universal basic colour terms by Berlin and Kay (1969) in accordance with the findings in their study on 98 languages. Besides the study of Berlin and Kay (1969), Hård (1969) states that in order to simplify the verbal communication about colours out of thousands, people perceive about eleven different colours categories. It was believed according to the statements of Berlin and Kay (1969) and Hård (1969) that, these eleven basic colour categories subsume all possible colours that people perceive their surroundings. It was also believed in terms of this thesis that the attitudes of individuals towards colours could be defined and described by the help of these eleven basic colour categories. Therefore, eleven basic colour categories, i.e. black, grey, white, yellow, orange, red, pink, purple, brown, blue and green, were used as stimuli for the experiment by referring to as eleven basic colours throughout the research. One problem of these eleven basic colours was which of each basic colour corresponded with its name mostly or precisely according to the perceiver was of great importance because the perception of colours and the corresponding names of the colours varied according to the educational, social and cultural backgrounds of people. As the experiment was carried out with Turkish participants living in Turkey, the representations of eleven basic colours were difficult to be in accord with the findings of the previous cross-cultural studies on colour naming. For this reason, Şahin Ekici et al.'s (2006) research on 'Color Naming' was utilised to select the basic colours for the experiment. This aforesaid research was conducted in six cities located in different regions of Turkey with the participation of Turkish people by asking 322 participants to select colour samples from Munsell Colour System which corresponded mostly to eight basic (except black, grey and white colours) and 24 non-basic colour terms. In the course of this experiment, basic colours were needed to be employed therefore only the results of eight basic colours from Şahin Ekici et al.'s (2006) study were taken into consideration. As the result of Şahin et al.'s (2006) study, the frequency of salient colours under eight basic colour categories exist with more than one colour which means that each basic colour category has the number of colours that correspond to its name precisely. For the experiment, eight basic colours were selected randomly from each set of colour categories and their Munsell notations were translated into Natural Colour System (NCS) colour notations. The reason for that was, for this research, the NCS colour notation system was preferred to be used as the language of colour communication. In accordance, three basic colours which are black, grey and white were selected from the achromatic scale of NCS colour atlas. After determining the definite list of eleven basic colours, their original samples in size A6 (148 x 105 mm) were order from NCS Colour AB to be used for the experiment.

The experiment was conducted on voluntary participation of the undergraduate students of METU Faculty of Architecture. It was carried out with the participation of 60 undergraduate students, 35 from Department of Industrial Design and 25 from Department of Architecture. Thirty of the participants were male and 30 were female.

Before conducting the experiment, a pilot study was carried out in order to identify the potential problems that might affect the quality and validity of the main study. The purpose was mainly on the examination of the methods and the procedures of the RGT. The RGT is considered as a structured interview technique for the elicitations of idiosyncratic/personal constructs of individuals and the exploration of their structure and interrelations. The main purpose of the RGT is to elicit the ways in which individuals construct the world around them in their own terms. Although there are a variety of procedures for the elicitation of personal constructs, the most popular and common procedure for generation constructs is to elicit them by means of triads which is considered as a classical approach. This procedure involves selecting three elements (triad) from a pool of elements (or stimuli) and presenting them at a time. Respondents then are asked to identify in what way two of these elements are similar/alike and yet different from the third element. The alternative way of generating constructs is to elicit them by means of dyads, or in other words by using pair of elements. This procedure involves selecting two elements (dyads) from a pool of elements (or stimuli) and presenting at a time. Respondents then are asked to identify whether two elements are similar/alike or different and what it is that makes them similar/alike or different. The result of both

procedures is a list of bipolar personal constructs that the respondent uses to distinguish between a set of elements in their own words. Since the RGT is adapted for the first time for distinguishing the similarities and differences between a set of colours, the interest of the pilot study thus was to determine which of the elicitation procedures were appropriate for generating idiosyncratic/personal attitudes of individuals in their own words by means of either triads or dyads of colours. As a result, the dyadic attitude elicitation procedure was found to be much more applicable than the triadic procedure and it was decided to be used as the main data collection procedure for the experiment.

Through the findings of the pilot study, the experiment took place with 60 volunteered participants in order to elicit the participants' ways of construing and giving meanings to eleven basic colours in their own words. Each participant was led into the experiment room individually and was seated at a desk on which the viewing cabinet was situated. Before the procedure, each participant was shown a total of ten Ishihara colour test plates in order to test whether the participant had colour vision deficiencies. After determining that each participant had a normal colour vision, he/she then was given a brief explanation on what was expected from the session verbally and the researcher carried out a quick demonstration of the attitude elicitation procedure. Afterwards, the participant was left free for a few minutes to familiarise him/herself with eleven basic colours in the viewing cabinet and also with the lighting conditions in the experiment room.

The experiment was performed in two steps of procedures, structured interview and rating method which are already employed in the RGT. The interview of the dyadic elicitation procedure was carried out face-to-face with each participant. The face-to-face interview of each participant in the experiment was in the form of dialogues between the participant and the researcher. The researcher administered the questions verbally which are as structured in the RGT and unique for each participant. As the generation of idiosyncratic/personal attitudes of the participants were based on to elicit them by means dyads of colours, when the participant was ready, first randomly drawn pair of colours was placed in the viewing cabinet and the participant was asked to specify whether the two colours in the cabinet were alike or different. After the participant identified their alikeness or differences, he/she was requested to say verbally what it was that made these colours alike or different or how these two colours were alike or different. The answer given by the participant was accepted as the emergent pole of his/her personal attitude and was written down on the right-hand side of his/her repertory grid table. Then, the participant was asked the opposite pole of his/her emergent pole; the given answer was accepted as the implicit pole of his/her personal attitude and was written down on the left-hand side of his/her repertory grid table. The participant was requested to deliver his/her constructs about the presented basic colours in the form of phrases or adjectives. This procedure continued until the participant was unable produce new personal attitudes for the first set of dyad of colours. Afterwards, the second randomly drawn pair of colours was placed into the viewing cabinet and the same procedure was performed. The dyadic elicitation procedure sustained presenting successive dyads of colours with performing the same elicitation procedures until the participant got saturated or bored. By this way, the list of dichotomous personal attitudes with two polar adjectives was obtained depending on the ways in which the participant thought of/construed/gave meanings to the presented basic colours in his/her own words. Once the personal attitudes of the participant were obtained by using dyads of colours, the elicited personal attitudes were employed with rating process which is the second step of the procedure of the RGT.

A subsequent rating process was of great importance to derive the mathematical relationship between the participant's elicited personal attitudes and eleven basic colours. This mathematical description provided the exact representation of what the participant wanted to define about each basic colour. This was done by placing all eleven basic colours into the viewing cabinet after eliciting the dichotomous personal attitudes from each set of dyad of colours, before moving on to the next sets of dyads of colours. The participant was asked to rate each of his/her own elicited bipolar attitudes on each basic colour in turn on a seven-point rating scale. This scale was from 1 to 7 and the participant was requested to give each of the colours one of the numbers, 1, 2, 3, 4, 5, 6, or 7 to say which end of the the scale the bipolar attitudes were nearest to. A rating of '1' related to the

adjectives of the attitude pole on the left-hand side of the grid and a rating '7' related to the adjectives of the attitude pole on the right-hand side which defined the extreme ratings of two poles. Subsequently, each elicited attitude on the grid of the participant was rated on each basic colour in turn before moving on to the next attitude. The ratings of eleven basic colours were to quantify the qualitative insight of the elicited personal attitudes of the participant. The session ended up when the participant was unable to generate new attitudes and all the elicited attitudes were rated on each basic colour. Up to presenting the first randomly drawn dyad of colours in the viewing cabinet, the process of the experiment was the same for each participant. However, beginning from presenting the first pair of colours, each elicitation interview was unique for each participant. This indicates that the number of randomly drawn dyads of colours that were utilised and the number of bipolar personal attitudes that were generated by eliciting them by means of the presented dyads accordingly depended on the performance and interest of each participant. Subsequently, the experiment was conducted with 60 participants and as a result, 60 separate repertory grids were obtained from the participants in order to be used as the main data set of this research.

In the following sections, the findings of the experiment are discussed and appraised in relation to the theoretical backgrounds of the studies on colour meaning and colour emotion. Next, the limitations of the experiment are described and aftermost, ideas for the further research are suggested.

7.1 Discussions on the Findings

The research aimed at determining the ways in which the individuals think of, construe and give meaning to eleven basic colours in their own words and examining the structure and interrelations between the elicited idiosyncratic attitudes and eleven basic colours. The objectives of this research were having fourfold:

- to examine each participant's own elicited idiosyncratic/personal attitudes;
- to explore the interpersonal relations of the common elicited attitudes;
- to explore the underlying factors of the common elicited attitudes and their relatedness among eleven basic colours; and
- to investigate the relationship between the common elicited attitudes and eleven basic colours.

7.1.1 Discussions on the Participant's Elicited Idiosyncratic/Personal Attitudes

During the experiment, 60 repertory grid interviews resulted in eliciting 60 individual repertory grid tables each of which containing the idiographic views of the participants on eleven basic colours. With regard to the first objective, the qualitative application of content analysis was utilised in order to analyse the elicited raw data of 60 participants. Each repertory grid included a number of response scales, or in other words bipolar personal attitudes, which used each participant's own thinking or construing in order to distinguish between the set of eleven basic colours as the subject matter on which the ratings of each basic colour were carried out. Each participant's raw data was initially transferred into the computer separately in order to be used as data sets. Then, each repertory grid data was reviewed by focusing on the content and contextual meanings of the elicited bipolar attitudes. In the process of reviewing, the researcher primarily manipulated the elicited bipolar attitudes when different words were being used for the same attitude by rephrasing or omitting them from the repertory grid of each participant. Furthermore, the attitudes which composed of more than one words on both poles of the repertory grid of each participant were

converted to a single attitude or rephrased to a new attitude according to their underlying meanings. These were done so as to be sure the equivalence of the word labels that the participants used to express their attitudes in order to distinguish between eleven basic colours. Lastly, the elicited attitudes that were not significant to the purpose of this research, in order words, the attitudes which did not represent what the researcher claimed to measure, were omitted from the repertory grid of each participant. As the result of the qualitative content analysis, a total of 606 bipolar personal attitudes were elicited by presenting a total of 228 dyadic sets of basic colours. Eleven basic colours have 55 probabilities to appear in different sets of different dyads; therefore, it is assured in terms of the total amount of dyads that were presented during the experiment that, each basic colour appeared at least once in the dyads presented. It can be concluded with a clear conscience that each basic colour was used in the experiment for the elicitation of the personal attitudes of the participants.

7.1.2 Discussions on the Interpersonal Relations of the Common Elicited Attitudes

The second objective, to explore the interpersonal relations of the common elicited attitudes, was approached through both qualitative and quantitative content analysis of the resulted data. Although utilising the RGT in order to determine the ways in which the participants construe and give meaning to eleven basic colours resulted in obtaining a number of individual repertory grid tables, they had some basic structures that were common among the participants. These were; i. a constant number of colours which were eleven basic colours and ii. a constant rating system which was the seven-point rating scale running from 1 to 7 to rate each basic colour on each personal attitude. These were the shared structures among the participants; during the experiment only the list of the elicited personal attitudes varied in each repertory grid table of each participant. From this fact, the participants' repertory grid tables were compared and analysed interpersonally because it was thought these idiographic views of the participants in each repertory grid table provided a common frame for exploring the shared attitudes. The commonality corollary of the personal construct psychology supports this approach by defining it as follows, "To the extent that one person employs a construction of experience which is similar to that employed by another, his psychological processes are similar [shared] to those of the other person" (Kelly, 1955/1991, p. 63).

In accordance, each (in total 60) repertory grid table was reviewed again in order to make them identical to analyse the elicited bipolar attitudes and their ratings of each basic colour interpersonally. In this case, each previously tabulated repertory grid was converted into a new table. This was done by gathering the positive word labels of the attitudes on the left-hand pole and the negative word labels on the right-hand pole of the new table of each participant. The reason for this was to see the shared patterns of the personal attitudes in each repertory grid table. After converting the positions of the word labels of the attitudes in each grid, regarding the attitudes' positions, the already had been obtained ratings of eleven basic colours on each attitude were transformed into new ratings as well. Afterwards, a total of 606 bipolar personal attitudes were translated into English and were collated by grouping the words that had precise meaning like synonyms or the words that shared similar connotations in referring to the same attitude together. Each group then was given a new label that corresponded to the meaning underlying the elicited attitudes in that group and different attitudes which had similar connotations of the group were converted into the same given attitude. In summarising the 606 bipolar attitudes elicited, 102 common bipolar attitudes were obtained. The result was the table of common attitudes and the average ratings of eleven basic colours across the frequency of mentioning of the common attitudes. The list of common attitudes on this table was regarded as the most pertinent and meaningful representations of the participants' ways of construing and giving meaning to eleven basic colours.

McDonagh and Adams-Weber (1987) find in a study that there is no overlap at the subjective rankings of importance of the personal constructs that are elicited early (i.e. the elicited first five constructs) than those that are elicited later (i.e. the elicited last five constructs). However, they find further that people are concerned about the first five constructs elicited and regard them as

important and more personally meaningful to them. In accordance with the assumption of the aforementioned study, with regard to the frequency of mentioning of the participants for each common bipolar attitude, the first five elicited common bipolar attitudes are as follows: 1) *natural-artificial* (53% of total); 2) *bright-dim* (45% of total); 3) *harmonious-disharmonious* (43% of total); 4) *light-dark* (40% of total); and 5) *dominant-recessive* or *dynamic-static* (35% of total). It can be concluded that, these common attitudes tend to be more important and meaningful to the participants in construing eleven basic colours than the other common attitudes that were elicited in the list. Most of these response scales, such as *bright-dim*, *light-dark*, *dynamic-static*, have been provided to be used in the colour studies (Hogg et al., 1979; Kobayashi, 1981; Sivik and Taft, 1989; Hsiao, 1995; Sato et al., 2000[63]; as cited in Ou, 2004; Xin et al., 2004) in order to investigate the connotative meanings and emotional associations of single colours and/or colour-combinations. No studies have been found in the literature of colour meaning (Osgood et al., 1957; Sivik, 1974a) or colour emotion (Kobayashi, 1981; Ou et al., 2004a) where the rating scale *natural-artificial* is used to explore which of the colours are perceived by the individuals as *natural* or *artificial*. The present result indicates that the majority of the subject group, i.e. 53% of the total population, think of and construe eleven basic colours in terms of either being *natural* or *artificial*. In accordance with this finding, it can be said that *naturalness* and/or *artificialness* of colours appear to be meaningful to the individuals in construing the perceived colours.

With respect to the results of the interpersonal repetitions of the common attitudes, the attitude *harmonious-disharmonious* is another bipolar adjectival scale that was elicited and which tends to be regarded as important and meaningful to the participants in construing eleven basic colours. This rating scale is more often used in the colour meaning (Sivik and Taft, 1989) and colour emotion (Ou et al., 2004b) studies in order to examine which of the colour-combinations are judged to be *harmonious* or *disharmonious*. In other words, searching for *harmoniousness* and *disharmoniousness* of colours are the main subject matter of the studies on colour- combinations. Although the present research was based on determining the individuals' ways of construing the isolated colours in their own words rather than the colour-combinations, the attitude scale *harmonious-disharmonious* was elicited as a result of the experiment. This was because during the experiment the pairs (dyads) of basic colours were presented to the participants and they were asked to specify whether the presented two colours were alike or different. After specifying their alikeness and differences, the participants were expected to define verbally what it was that made these two basic colours alike or different. It was observed during the interview procedure of the RGT that, the term *harmonious* was elicited when the presented two colours were seen to be alike by the participants. Furthermore, it was observed that the presented two colours might also be seen to be alike because of their *disharmoniousness*. On the other hand, it was also observed that the term *harmonious* elicited when the presented two colours were seen to be different by the participants. In this instance, while one colour out of the presented pair of basic colours was construed as *harmonious*, the other basic colour was construed as *disharmonious*. In all cases, when the implicit (opposite) poles of the elicited emergent poles were asked, it was specified as either *harmonious* or *disharmonious* resulting in eliciting the rating scale *harmonious-disharmonious*. Although the researcher was in doubt about how the participants rated each basic colour without the colours nearby on a seven-point scale, during the rating processes, it was seen that eleven basic colours were easily rated in turn on this scale. In accordance, it can be concluded that, the term *harmony* is the subject matter when two colours are seen to be alike. Colour harmony is what Judd and Wyszecki (1975[64]; as qtd. in Ou, 2004, p. 77) define as "when two or more colours seen in neighbouring areas produce a pleasing effect, they are said to produce a colour harmony." This result is in line with the colour studies (Sivik and Taft, 1989; Ou et al., 2004b) as to why the scale *harmonious-disharmonious* is used for the evaluations of the colours in combinations. However, the present research finds that the isolated

[63] Sato, T., Kajiwara, K., Hoshino, H., & Nakamura, T. (2000). Quantitative evaluation and categorising of human emotion induced by colour. *Advances in Colour Science and Technology, 3*, 53-59.

[64] Judd, D. B., & Wyszecki, G. (3rd Ed.). (1975). *Color in business, science and industry*. New York: John Wiley & Sons.

colours can also be differentiated, judged, rated and more importantly perceived as either *harmonious* or *disharmonious* in addition to the colours that are being in combinations. This result shows the evidence that, construing the isolated colours as *harmonious* and *disharmonious* are important and meaningful to the participants. As a consequence, the rating scale *harmonious-disharmonious* can be provided to be used as a supplemental scale for evaluating the meanings and the emotional associations of isolated colours in colour studies. On the contrary, McDonagh and Adams-Weber (1987) find in a study that the constructs that are elicited are more personally meaningful to the subjects than provided ones. In regard of this assumption, further research, however, will be needed to investigate the differences between two aforesaid approaches of judging the isolated colours in terms of their associations to *harmonious-disharmonious* rating scale. Since the present research finds that, *harmoniousness* and *disharmoniousness* of the isolated colours are meaningful to the participants through eliciting their attitudes in their own words, the participants might not find as meaningful as in this research when *harmonious-disharmonious* rating scale is used to judge the isolated colours through providing it. The reason for this is that, as Fallman and Waterworth (2005) claim, the RGT is mainly focused on eliciting the constructs that are meaningful to the participants.

With regard to the frequency of mentioning of the common elicited attitudes, the chi-square goodness of fit test was applied to the repertory grid data in order to explore the gender differences. For the chi-square approximation to be valid, the test offers that the number observations in each level of the variable should be at least five (Kalaycı, 2010). This referred to 42 common attitudes, i.e. the attitudes mentioned by five and more participants, which indicated 82% of the full gathered list, i.e. a total of 102 common attitudes. The result of the chi-square goodness of fit test showed that there were no significant differences between the female and male participants in terms of the frequency of mentioning of 42 common attitudes (chi-square: 10,963, df: 4, $p<0.05$). However, the female participants elicited significantly more attitudes than the male participants.

In this respect, for further statistical analyses to be conducted, a decision was taken that the common attitudes which were mentioned by five and more participants carried more reliable in understanding the ways in which the participants construe eleven basic colours than less frequently mentioned common attitudes. Therefore, in order to support this decision and to see to what extent the obtained data is consistent, the internal consistency reliability of the repertory grid data was assessed by using 42 common attitudes. In regard of the result of Cronbach's Alpha (α: 0.92), the data with 42 common attitudes, each with a seven-point rating scale running from 1 through 7, was found highly reliable and internally consistent. Therefore, further statistical analyses were done upon this data set, consisting of 42 common attitudes, in order to obtain more reliable and valid results as the suggestion of the goodness of fit test.

The repertory grid data, up to this point, was driven by semantic analyses of the content of the elicited personal attitudes of the participants towards eleven basic colours rather than taking the numerical data into account. The obtained repertory grid data consisted of not only the personal attitudes towards eleven basic colours but also, through the rating, the degree of their associations to each basic colour. With regard to make some observations about the ways in which the attitudes were used, the means and standard deviations of each of 42 attitudes across eleven basics were calculated. The result of the mean statistics shows that, 42 attitudes across eleven basic colours are relatively close to the midpoint, i.e. '4'. This indicates that no attitude scales are lopsided, in other words, one pole of the attitude scale is not used considerably more than the other pole of the attitude scale by the participants. On the other hand, the result of the standard deviation statistics shows how each colour varies across the elicited 42 attitudes. It is found that eleven basic colours are most widely dispersed on the attitudes *frivolous-solemn*, *mature-immature* and *alive inanimate*. This indicates that eleven basic colours are described by these attitudes more explicitly than the other attitudes. In other words, eleven basic colours were rated on more with the extreme values; i.e. '1' and/or '7' end of the scales, of these attitudes. Instead, eleven basic colours are least dispersed on the attitudes *sincere-insincere* and *modern-traditional*. This shows that, the participants

did not make a distinct decision on which of the opposing poles of these attitudes were much more associated with eleven basic colours.

7.1.3 Discussions on the Underlying Factors of the Common Attitudes and Their Relatedness among Eleven Basic Colours

The third objective, to explore the underlying factors (dimensions) of the common elicited attitudes and their relatedness among eleven basic colours, was approached through exploratory factor analysis and one sample t-test statistics, respectively. The purpose of applying factor analysis was to group the number of elicited variables, i.e. 42 common attitudes, into coherent and meaningful dimensions/factors. In other words, the purpose is to see whether there are a finite number of factors that underlies these elicited attitude scales. In regard of the results of the factor analysis, four factors were obtained by excluding *masculine-feminine* attitude scale from the analysis. The reason for this was that, the rotated factor structure of the first run of the factor analysis of 42 attitudes showed the attitude scale *masculine-feminine* was significantly cross-loaded across Factor 2 and Factor 4. Therefore, this attitude scale was deleted as the suggestion of Ho (2006) who indicates that the deletion of cross-loaded items clarifies the factors and makes their interpretations easier. As a result, this four-factor model appears to reflect adequately the underlying factor structure of 41 common attitudes of the participants towards eleven basic colours. Before going into the further discussions on the extracted factors, the attitude scale *masculine-feminine* is found valuable to be discussed on.

7.1.3.1 Discussions on the Attitude Scale *Masculine-Feminine*

With regard to the results of the interpersonal repetitions of the common attitudes, the attitude *masculine-feminine* was mentioned by only eight out of 60 participants (a total of 13%). It was observed during the interviews of these participants that, the term *feminine* was elicited when there were *pink*, *purple*, *red* and *white* in the presented dyads of the basic colours. Whereas, the term *masculine* was elicited when there were *black*, *blue* and *grey* in the presented dyads of the basic colours. In order to make some observations about the ratings of eleven basic colours on the attitude *masculine-feminine*, the descriptive statistics of this attitude was calculated. Table 7.1 presents the results. In regard of the standard deviations of eleven basic colours, *brown* (SD: 1.55) is most widely dispersed basic colour on the attitude *masculine-feminine*. This indicates that *brown* was rated with more extreme values, i.e. either extremely *masculine* or *feminine*, on this attitude than the other basic colours. On the other hand, *pink* (SD: 0.52) is the least dispersed basic colour. The mean statistics and the minimum and maximum values of this colour show that, *pink* (M: 6.63) was rated more substantially by using the right pole (i.e. *feminine*) more than the left pole (i.e. *masculine*) of the attitude.

Table 7.1 The descriptive statistics of the attitude *masculine-feminine*

Descriptive Statistics of the Attitude *masculine-feminine*

Eleven Basic Colours	N	Min.	Max.	Mean	Std. Dev.
Black	8	1.0	4.0	1.50	1.07
Grey	8	1.0	4.0	2.75	1.16
White	8	4.0	7.0	5.75	1.28
Yellow	8	4.0	6.0	5.00	0.93
Orange	8	4.0	6.0	5.00	0.93
Red	8	4.0	7.0	6.50	1.07
Pink	8	6.0	7.0	6.63	0.52
Purple	8	4.0	7.0	5.25	1.28
Brown	8	1.0	5.0	2.88	1.55
Blue	8	1.0	4.0	2.63	1.06
Green	8	3.0	5.0	4.38	0.74
Valid N (listwise)	8				

The semantic differential chart in Figure 7.1 presents the patterns of the ratings of eleven basic colours on the attitude *masculine-feminine*. In the chart, the vertical dotted line is used to show the midpoint, i.e. 4, of the seven-point rating scale running from 1 through 7.

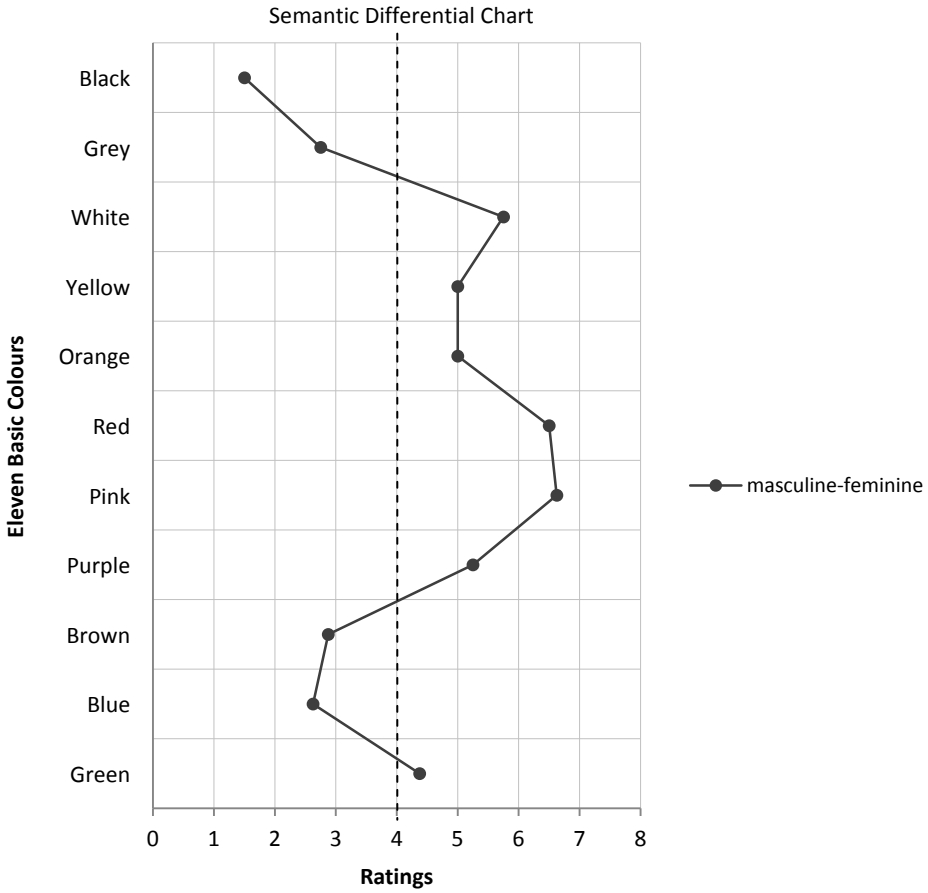


Figure 7.1 The patterns of the ratings of eleven basic colours on the attitude *masculine-feminine*

As indicated in Figure 7.1, the basic colours *white*, *yellow*, *orange*, *red*, *pink*, *purple* and *green* were rated more considerably by using right pole, i.e. *feminine*, of the attitude scale. On the other hand, the basic colours *black*, *grey*, *brown* and *blue* were rated more considerably by using the left pole, i.e. *masculine*, of the attitude scale. While the participants rated *red* and pink on this scale by considering it as extremely *feminine*, they rated *white* as quite *feminine*. While *yellow*, *orange* and *purple* were perceived as slightly *feminine*, *green* was perceived as neither *masculine* nor *feminine*. On the other hand, *black* was rated as extremely *masculine* by the participants and *grey*, *brown* and *blue* were rated as slightly *masculine*. Beyond these results, during the interviews, it was observed that most of the participants did not want to construe eleven basic colours according to the gender differences. In view of that, they did not elicit their attitudes by using the terms *masculine* or *feminine*. Sivik (1974c) finds similar results in a study where many of the subjects consider the provided scale *masculine-feminine* to be irrelevant to classify the colours. In regard of this finding, it can be concluded that *masculinity* and/or *femininity* of the colours do not tend to be regarded as important and meaningful to the individuals while construing them.

7.1.3.2 Discussions on the Underlying Factors of the Common Attitudes

As the result of factor analysis, as has already been stated, four dimensions/factors were extracted. In other words, eleven basic colours against 41 common attitudes were accounted for in terms of four factors. Each factor was characterised by assigning it a name or label according to the underlying dimensions that unifies the group of variable loading on it. Crozier (1996; p. 71) suggests that "Further research could allow people to nominate their own dimensions [factors], perhaps by using repertory grid approaches." Although some of the extracted factors were labelled by making use of Osgood et al.'s (1957), Wright and Rainwater's (1962), Hogg's (1969), Sivik's (1974a), and Mehrabian and Russell's (1974[65]) theories regarding their studies on colour meaning and emotion, some of them were labelled by attaching psychological meanings regarding the attitude scales with high correlations (loadings) on them. These four factors are labelled as follows; 1) *activity*, 2) *lightness-purity*, 3) *evaluation* and 4) *familiarity*. As a result, it can be said that these four dimensions reflect adequately the underlying factor structures of 41 common attitudes of the participants towards eleven basic colours.

Factor 1, which is *activity* is characterised by the attitude scales with high loadings: *exciting-calming*, *vivid-pale*, *energetic-calm*, *dynamic-static*, *active-passive*, *conspicuous-inconspicuous*, *soothing-disturbing*, *alive-inanimate* and *charming-charmless*. This factor explains the largest proposition of the overall variance (49.98% of variance) and approximately half of the variables (i.e. 19 out of 41 common attitudes) loaded only in one factor. It is agreed well with the activity factor (including scales such as active-passive, hot-cold, excitable-calm) identified by Osgood et al. (1957), the excitement factor (including scales such as exciting-soothing, stimulating-dull, active-passive) identified by Sivik (1974a) and the arousal factor (including scales such as excited-calm, stimulated-relaxed) identified by Mehrabian and Russell (1974). In regard of the root-mean-square (hereinafter RMS) correlation, the attitude scale *active-passive* was found to be the most associated attitude with other attitudes overall within the *activity* factor. The attitude scales *exciting-calming*, *vivid-pale*, *energetic-calm* and *dynamic-static* were found to be the next most closely associated attitudes with others. In accordance with these findings, it is agreed that, this factor not only refers to the necessity of making movements of adjustments to the perceived colours but also constitutes the physical activity and a mental alertness of the individuals (Carroll, 195; Valdez, 1993; Mehrabian, 1996). Although Wright and Rainwater (1962), Hogg (1969), Sivik (1974a) and Ou et al. (2004a) find another factor in their studies on the connotative meanings and emotional associations of single colours, namely as warmth, temperature or colour heat, which is defined by the scale *warm-cool*, the result of factor analysis in the present research shows that, the same attitude scale was grouped under the *activity* factor with a high loading.

[65] Mehrabian, A., & Russell, J. A. (1974). *An approach to environmental psychology*. Cambridge: MIT Press.

Factor 2, which is *lightness-purity* is characterised by the attitude scales with high loadings: *heavy-light*, *refreshing-suffocating*, *innocent-malicious*, *light-dark*, *pure-impure*, *luminous-dark*, and *restful-restless*. This factor explains the next largest proportion of the overall variance (24.55% of a variance) and approximately one-third of the variables loaded on this factor (15 out of 41 common attitudes). It was labelled by attaching a meaning by the researcher regarding the attitude scales with high loadings on this factor. The labelled name *lightness* has two antonyms due to the fact that they have a variety of linguistic meanings. For instance, *light* has antonym of *heavy* and also has antonym of *dark*. Therefore, the name *lightness* on this factor refers to both the terms 'weightless or not heavy' and 'not dark'. The labelled name *purity*, on the other hand, has a number of synonyms. It refers to the terms 'clean', 'innocent', 'clear', 'fresh', 'immature' and 'pure' of the loaded attitude scales on this factor. As regards the RMS correlation, the attitude *refreshing-suffocating* was found to be the most associated attitude with other attitudes overall with this factor. The attitudes *innocent-malicious* and *luminous-dark* were found to be the next most closely associated attitudes with the others. In the light of these findings, this factor was thought of as indicating that this is a type of *lightness-purity* factor.

Factor 3, which is *evaluation* is characterised by the attitude scales with high loadings: *beautiful-ugly* and *modern-traditional*. This factor explains the third proportion of the overall variance (10.20% of a variance) and consists of three out 41 common attitudes. It is agreed well with the evaluation factor (including scales such as good-bad, beautiful-ugly, pleasant-unpleasant) identified by Osgood et al. (1957), the evaluative factor (including the scale pleasantness-unpleasantness) identified by Hogg (1969), the evaluation factor (including scales such as positive-negative, beautiful-ugly, like-dislike) identified by Sivik (1974a), and the pleasure factor (including scales such as pleased-annoyed, happy-unhappy, satisfied-unsatisfied) identified by Mehrabian and Russell (1974). Sivik (1974a) states that the evaluation factor is considered to be the most interesting dimension of colour semantics. The reason for this is that, the pleasantness, beautifulness and likeness of colours are the subject matters of colour preference research and Sivik (1974a) claims that colour preference is evaluative and has an affective value. Green-Armytage (1996; p. 205) defines this as "[…] to say that a flag [for instance] is blue and yellow is description, while to say that it is beautiful is evaluation." In regard of the RMS correlation, the attitude *beautiful-ugly* was found to be the most associated attitude with other attitudes overall within the *evaluation* factor. In accordance with this finding, it is agreed that, this factor associates with greater pleasure induced by the perceived colours (Mehrabian, 1996).

Factor 4, which is *familiarity* is characterised by the attitude scales with high loadings: *familiar-unfamiliar* and *natural-artificial*. This factor explains the smallest proportion of the overall variance (6.96% of a variance) and consists of four out of 41 common attitudes. It was labelled by attaching a meaning by the researcher regarding the attitude scales with high loadings on it. Although the connection between these two high loadings scales seemed to be clear, it was difficult to characterise this factor by a general term. In regard of the RMS correlation, the attitude *familiar-unfamiliar* was found to be the most associated attitude with other attitudes overall within this factor. In the light of this finding, it was thought of as indicating that this is a type of *familiarity* factor. The attitude scale *strong-weak* was also grouped under the factor of *familiarity* with a lowest loading, although this scale characterises the dimensions of potency, forcefulness or strength in the studies of Osgood et al. (1957), Wright and Rainwater (1962), Hogg (1969), and Sivik (1974a).

In order to see to what extent these extracted four factors are related with each other; Pearson's product-moment correlation coefficients of the factors were calculated. With respect to the results, no correlations were found among four factors of the attitudes over eleven basic colours. This finding indicates that 41 attitudes are well dissociated among *activity*, *lightness-purity*, *evaluation* and *familiarity* factors.

7.1.3.3 Discussions on the Relatedness of Four Factors among Eleven Basic Colours

The third objective also intended to explore the relatedness of these four factors among eleven basic colours. This was approached through one sample t-test statistics. The purpose of utilising t-test was to determine which of the basic colour(s) over other basic colours were significant among each four factor. The connection with the relations of the factors *activity*, *lightness-purity*, *evaluation* and *familiarity* to eleven basic colours are thoroughly summarised in the following.

- *Orange* and *red* are significantly associated with positive *activity*, whereas *grey*, *white* and *brown* with negative *activity*.

- *Red* is significantly associated with negative *lightness-purity*.

- *Black*, *orange* and *purple* are significantly associated with positive *evaluation*, whereas *brown* is with negative *evaluation*.

- *Brown* and *blue* are significantly associated with positive *familiarity*, whereas *orange* and *pink* with negative *familiarity*.

Warner Schaie (1961) reports in a study that, the activity-passivity factor is positively associated with yellow; however, in the present research, no significant associations of *yellow* either positively or negatively with *activity* factor and along with any of the other factors were found. Adams and Osgood (1973) find in a cross-cultural study that, red is strongly associated with positive activity. The finding of the present research about the red colour is matched with the results of these authors. Warner Schaie (1961) further reports that, the activity-passivity factor is negatively associated with black, purple, grey and brown. Adams and Osgood (1973) find similar results for black and grey. Except black and purple, the findings in the present research show parallelism with the aforementioned studies. Warner Schaie (1961) find that, the quality of emotional tone factor, i.e. corresponds to Osgood's evaluation factor, is negatively associated with black. However, the present research disagrees on the findings of this author and states that *black* is associated with positive *evaluation*. As a consequence, no other similarities and/or differences are found in colour literature with the abovementioned results of the connection with the factors *activity*, *lightness-purity*, *evaluation* and *familiarity* to eleven basic colours. In regard of the t-test results, like *yellow*, *green* has no significant associations either positively or negatively with any of four factors.

7.1.4 Discussions on the Relationship between the Common Attitudes and Eleven Basic Colours

The fourth objective, to investigate the relationship between the common elicited attitudes and eleven basic colours, was approached through bivariate correlation, hierarchical cluster analysis and one sample t-test statistics. The single repertory grid data which consisted of 41 common attitudes and the average ratings of eleven basic colours across the frequency of mentioning of the common attitudes contained a great amount of information. This information included; i. the relationship amongst the attitudes, ii. the relationship amongst eleven basic colours, and iii. the relationship between the attitudes and eleven basic colours. It was thought of as indicating that, in order to investigate the interrelations between the attitudes and eleven basic colours, these aforementioned relationships were analysed within each four factor. To this end, the analyses were conducted in terms of three steps:

1. The relationships among the attitudes within each four factor were analysed by using bivariate correlation.

2. The relationships among eleven basic colours within each four factor were analysed by using hierarchical cluster analysis.

3. The relationships between the attitudes and eleven basic colours within each four factor were analysed by one sample t-test.

For the first step of the analyses, the correlations among the attitudes were calculated within each four factor, i.e. *activity*, *lightness-purity*, *evaluation*, and *familiarity*. The purpose was to see the associations of the attitudes.

7.1.4.1 Discussions on the Relationships among the Attitudes within Each Four Factor

In regard of Pearson's product-moment correlation of 19 attitudes within the *activity* factor, the major findings (in terms of very close associations of the attitudes) are summarised in the following (see Section 6.2.1.1 for the full results).

- *Exciting* colours tend to be construed as *energetic*, *dynamic*, and *active*. *Calming* colours are likely to be perceived as *calm*, *static*, and *passive*.
- *Vivid* colours tend to be construed as *conspicuous*. *Pale* colours are likely to be perceived as *inconspicuous*.
- *Energetic* colours tend to be construed as *exciting*. *Calm* colours are likely to be perceived as *calming*.
- *Dynamic* colours tend to be construed as *exciting*, *active*, and *charming*. *Static* colours are likely to be perceived as *calming*, *passive*, and *charmless*.
- *Active* colours tend to be construed as *exciting*, *dynamic*, and *alive*. *Passive* colours are likely to be perceived as *calming*, *static*, and *inanimate*.
- *Conspicuous* colours tend to be construed as *vivid*. *Inconspicuous* colours are likely to be perceived as *pale*.
- *Disturbing* colours tend to be construed as *energetic*. *Soothing* colours are likely to be perceived as *calm*.
- *Alive* colours tend to be construed as *active*. *Inanimate* colours are likely to be perceived as *passive*.
- *Charming* colours tend to be construed as *dynamic*. *Charmless* colours are likely to be perceived as *static*.
- *Warm* colours tend to be construed as *disturbing*. *Cool* colours are likely to be perceived as *soothing*.
- *Entertaining* colours tend to be construed as *active*. *Boring* colours are likely to be perceived as *passive*.
- *Dominant* colours tend to be construed as *vivid* and *conspicuous*. *Recessive* colours are likely to be perceived as *pale* and *inconspicuous*.
- *Cheerful* colours tend to be construed as *dynamic* and *charming*. *Sad* colours are likely to be perceived as *static* and *charmless*.
- *Bright* colours tend to be construed as *alive*. *Dim* colours are likely to be perceived as *inanimate*.
- *Harmonious* colours tend to be construed as *solemn*. *Disharmonious* colours are likely to be perceived as *frivolous*.
- *Frivolous* colours tend to be construed as *cheerful*. *Solemn* colours are likely to be perceived as *sad*.
- *Aggressive* colours tend to be construed as *dominant*. *Calm* colours are likely to be perceived as *recessive*.
- *Expressive* colours tend to be construed as *conspicuous*. *Unexpressive* colours are likely to be perceived as *inconspicuous*.

The findings above are the results of the strongest correlations of the attitudes within the *activity* factor. Besides them all, the general findings are as follows. The colours that are construed as *exciting*, *energetic*, *dynamic* and *charming* tend to be perceived as *warm*. Levy (1984) suggests in a study that warm colours provoke active, positive and aroused feelings and the present finding is in line with Levy's suggestion. However, the interpretations of the correlation matrix obtained in the

present research show that, *warm* colours tend to be perceived as *disturbing* which is assumed to be indicative of the non-active, negative and non-arousing quality of an attitude. With reference to the results of the correlations of the attitudes, like *warm* colours, the colours which are *energetic*, *exciting*, *dynamic*, *vivid*, *active*, *conspicuous*, *alive* and *charming* are also likely to be perceived as *disturbing*. D'Andrade and Egan (1974) find in a study that, the emotional associations to colour usually seem to be due to the degree of saturation and brightness of that colour rather than the actual hue. In accordance, Valdez and Mehrabian (1994) report that arousal (activity) correlates positively with the saturation and brightness of a colour. In other words, these results suggest that the bright and highly saturated colours increase the active, positive and aroused feelings. According to the findings of the aforementioned authors, the findings of the present research may suggest that, the highly saturated and bright colours have also a tendency to be perceived as *disturbing* besides being indicative of positive and arousing quality of the attitudes. On the other hand, Levy (1984) reports in a study that cool colours have sedating effects. The present research finds a similar result suggesting, *cool* colours are perceived as *soothing*. Additionally, like *cool* colours, it is found that, the colours which are *calming*, *static*, *pale*, *passive*, *inconspicuous*, *inanimate* and *charmless* tend also to be perceived as *soothing*. Valdez and Mehrabian (1994) suggest that calmness correlates negatively with brightness which supports the findings of this present research. The results show the colours which are perceived as *calm* and *calming* are also likely to be seen as *pale*, *static*, *passive*, *inanimate*, *inconspicuous*, and *dim* in addition to be perceived as *cool* and *soothing*.

James (1890[66]; as cited in Cupchik, 1994) states that the primary layer of emotion in the aesthetic process involves subtle feelings like pleasure which is elicited by harmonious combinations of lines and colours. In accordance with James (1890), it is considered that harmony yields pleasure (Gardiner et al., 1970[67]; as cited in Cupchik, 1994). "[…] Colours will be harmonious and, therefore, pleasing", is expressed by Green-Armytage (1996, p. 205). Ou (2004; p. 77) defines colour harmony as "[…] a reactive-level emotional response in association with the subjective feeling of pleasure." This indicates that harmony is accompanied by emotion because of its pleasing effect and it can be said that harmonious colours are thus experienced as pleasing by the individuals. However, with regard to the interpretations of the correlations of the attitudes, the present research finds that, the colours which are construed as *harmonious* tend to be perceived as *solemn*. On the other hand, the colours which are perceived as *disharmonious* are likely to be seen as *frivolous*. No additional associations of the attitude scale *harmonious-disharmonious* are found with the other attitudes scales overall within the *activity* factor.

In regard of Pearson's product-moment correlation of 15 attitudes within the *lightness-purity* factor, the major findings (in terms of very close associations of the attitudes) are summarised in the following (see Section 6.2.1.2 for the full results).

- *Heavy* colours tend to be construed as *dark*. *Light* colours (opposite of *heavy*) are likely to be perceived as *light* (opposite of *dark*).
- *Refreshing* colours tend to be construed as *positive*. *Suffocating* colours are likely to be perceived as *negative*.
- *Innocent* colours tend to be construed as *luminous*. *Malicious* colours are likely to be perceived as *dark*.
- *Light* (opposite of *dark*) colours tend to be construed as *luminous*. *Dark* (opposite of *light*) colours are likely to be perceived as *dark* (opposite of *luminous*).
- *Pure* colours tend to be construed as *restful*. *Impure* colours are likely to be perceived as *restless*.
- *Luminous* colours tend to be construed as *light* (opposite of *dark*). *Dark* (opposite of *luminous*) colours are likely to be perceived as *dark* (opposite of *light*).

[66] James, W. (1890). *The principles of psychology: Volume 2*. New York: Dover.

[67] Gardiner, H. M., Metcalf, R. C., & Beebe-Center, J. G., (1970). *Feeling and emotion: A history of theories*. Westport, CT: Greenwood.

- *Restful* colours tend to be construed as *pure*. *Restless* colours are likely to be perceived as *impure*.
- *Clean* colours tend to be construed as *refreshing* and *luminous*. *Dirty* colours are likely to be perceived as *suffocating* and *dark* (opposite of *luminous*).
- *Positive* colours tend to be construed as *optimistic* and *cheering*. *Negative* colours are likely to be perceived as *pessimistic* and *gloomy*.
- *Hard* colours tend to be construed as *heavy*. *Soft* colours are likely to be perceived as *light* (opposite of *heavy*).
- *Clear* colours tend to be construed as *light* (opposite of *heavy*). *Complex* colours are likely to be perceived as *heavy.*
- *Optimistic* colours tend to be construed as *positive*. *Pessimistic* colours are likely to be perceived as *negative*.
- *Sincere* colours tend to be construed as *pure*. *Insincere* colours are likely to be perceived as *impure*.
- *Cheering* colours tend to be construed as *positive*. *Gloomy* colours are likely to be perceived as *negative*.
- *Mature* colours tend to be construed as *negative* and *pessimistic*. *Immature* colours are likely to be perceived as *positive* and *optimistic*.

The findings above are the results of the strongest correlations of the attitudes within the *lightness-purity* factor. Besides them all, the general findings are as follows. Ou et al. (2004a) find in a study of colour emotions for single colours that, the scale *heavy-light* has its strongest relation only with the colour dimension of lightness. In the present research, the similar result is found that, while the colours which are construed as *heavy* are also to be perceived as *dark* (opposite of *light*), the colours which are construed as *light* (opposite of *heavy*) are also to be seen as *light* (opposite of *dark*). In addition to them, the interpretations of the correlation results obtained in the present research show that, the colours which are *innocent*, *luminous*, *refreshing*, *pure*, *clean*, and *positive* are also likely to be construed as *light* (opposite of *heavy*). On the other hand, the colours which are *malicious*, *dark* (opposite of *luminous*), *suffocating*, *impure*, *dirty*, and *negative* tend also to be perceived as *heavy*. Additionally, the colours which are perceived as *hard*, *restless* and *complex* are likely to be seen as *heavy*, as well. Hogg et al. (1979) find in a study that, the complexity has linear relationship with the colour dimension of value or lightness. They state further that the colours which have medium value are generally seen as complex. However, in the present research, it is found that, the colours which are construed as *complex* are also likely to be perceived as *dark* (opposite of *light*), *suffocating*, and as well as *heavy*. Another finding of the aforementioned authors is that, the colours are judged as simple (synonym of *clear*) when they have low chroma but low or high value. Crozier (1996) supports this by stating as when the colours become darker, they are judged simpler. Nevertheless, the correlation results show in the present research that, the *clear* (or simple) colours are thus perceived as *light* (opposite of *dark*), *refreshing*, and as well as *light* (opposite of *heavy*). It was observed during the interviews of the participants that, the term *complex* was elicited when there were *purple* or *brown* in the presented dyads of colours. On the contrary, the term *clear* was elicited when there were *white* or *pink* in the presented dyads of colours.

In regard of Pearson's product-moment correlation of three attitudes within the *evaluation* factor, the major findings (in terms of very close associations of the attitudes) are summarised in the following (see Section 6.2.1.3 for the full results).

- *Beautiful* colours tend to be construed as *attractive*. *Ugly* colours are likely to be perceived as *repulsive*.
- *Attractive* colours tend to be construed as *beautiful*. *Repulsive* colours are likely to be perceived as *ugly*.

The findings above are the results of the strongest correlations of the attitudes within the *evaluation* factor. These results indicate that *beautifulness* and *attractiveness* have a very close association in

construing the perceived colours. This is also accurate for *ugliness* and *repulsiveness*. In accordance, no close associations of the attitude scale *modern-traditional* are found with the other attitude scales overall within this factor.

In regard of Pearson's product-moment correlation of four attitudes within the *familiarity* factor, the major findings (in terms of very close associations of the attitudes) are summarised in the following (see Section 6.2.1.4 for the full results).

- *Familiar* colours tend to be construed as *common*. *Unfamiliar* colours are likely to be perceived as *rare*.
- *Common* colours tend to be construed as *familiar*. *Rare* colours are likely to be perceived as *unfamiliar*.

The findings above are the results of the strongest correlations of the attitudes within the *familiarity* factor. These results indicate that *familiarity* and *commonness* have a strong correlation in construing the perceived colours. This is also valid for *unfamiliarity* and *rareness*. In accordance, no close associations of the attitude scales *natural-artificial* and *strong weak* are found with the other attitude scales overall within this factor.

7.1.4.2 Discussions on the Relationships among Eleven Basic Colours within Each Four Factor

For the second step of the analyses for the fourth objective, the hierarchical cluster analysis was computed on eleven basic colours in order for the relationships among the basic colours within each four factor, i.e. *activity*, *lightness-purity*, *evaluation*, and *familiarity* to be explored. The purpose is to identify the major groups of basic colours within each factor in terms of their strongest associations and to search for the patterns of the ratings of these clustered colours.

With regard to the cluster analysis, the strongest associations among eleven basic colours within the *activity* factor are; *yellow & orange*; *white & blue*; *grey & brown*; and *pink & purple*. These results indicate that the degrees of the associations of each of 19 attitudes within this factor to each of these four clustered basic colours are parallel. Each of these colour clusters are discussed in the following.

1. *Yellow* and *Orange*. These two basic colours cluster together which indicates that they share similar attitude associations within the *activity* factor. Regarding the patterns of the ratings in the semantic differential chart of *yellow & orange*, these colours were rated more considerably by using the left poles more than the right poles of 19 attitude scales (see Figure 6.2). In other words, the participants construed these colours by considering the positive poles of the attitudes scales. Although there were relatively small differences in the patterns of the ratings of two colours, they had overlapping ratings on some of the attitudes, i.e. they were rated as quite *exciting*, extremely *energetic*, quite *dynamic*, quite *conspicuous*, quite *charming* and quite *bright*.

2. *White* and *Blue*. These two basic colours tend to cluster together which indicates that they have parallel attitude associations within the *activity* factor. With respect to the patterns of the ratings in the semantic differential chart of *white & blue*, these colours were rated more substantially by using the midpoint of 19 rating scales (see Figure 6.3). This indicates that the participants construed these colours by using the expression of 'neither-nor' of the attitudes. However, these colours had overlapping ratings on some of the attitudes, i.e. *white & blue* were rated as slightly *calm* (opposite of *energetic*), neither *dynamic* nor *static*, neither *charming* nor *charmless*, neither *dominant* nor *recessive* and slightly *expressive*.

3. *Grey* and *Brown*. These two basic colours tend to cluster together which indicates that they share similar associations within the *activity* factor. Concerning the the patterns of the ratings in the semantic differential chart of *grey & brown*, these colours were rated more greatly by using the

right poles more than the left poles of 19 attitude scales (see Figure 6.4). That is to say, the participants construed these colours by considering the negative poles of the attitude scales. Their overlapping ratings on some of the attitudes are as follows. These two colours were rated as quite *calm* (opposite of *energetic*), quite *passive*, slightly *charmless*, quite *sad*, quite *dim*, quite *solemn*, quite *ordinary* and quite *unexpressive*.

4. *Pink* and *Purple*. These two colours cluster together which indicates that they have similar attitude associations within the *activity* factor. In regard of the semantic differential chart of the basic colours *pink & purple*, a systematic pattern of their ratings was not seen on 19 attitude scales though their patterns were perceived as relatively identical (see Figure 6.5). The participants rated these basic colours by using both the right and left poles of the rating scales. Although these colours were grouped together as the result of cluster analysis, it was seen in the dendrogram that, they were clustered together as at the larger distances than *yellow & orange*, *white & blue* and *grey & brown*. This means that while there are bigger distances of the combinations of the basic colours, there are bigger differences in the ratings of these colours. Despite these, *pink & purple* had overlapping ratings on some of the attitudes, i.e. they were rated as slightly *inanimate*, slightly *dim* and slightly *disharmonious*.

As a consequence, it can be said that, the basic colours *yellow & orange*, *white & blue*, *grey & brown*, and *pink & purple* are perceived as more identical than the other basic colours by the participants within the *activity* factor.

In regard of the cluster analysis, the strongest associations among eleven basic colours within the *lightness-purity* factor are; *yellow, orange & green*; and *purple & brown*. These results indicate that the degrees of the associations of each of 15 attitudes within this factor to each of these clustered basic colours are parallel. Each of these colour clusters are discussed in the following.

1. *Yellow, Orange* and G*reen.* These three basic colours cluster together which indicates that they share similar attitude associations within the *lightness-purity* factor. Concerning the patterns of the ratings in the semantic differential chart of *yellow, orange & green*, it was seen that these colours were rated more considerably by using the left poles more than the right poles of 15 attitude scales (see Figure 6.7). This means the participants construed these colours by considering the positive poles of the attitude scales within this factor. Even though there are relatively small differences of the patterns of the ratings of these three colours, they had overlapping ratings on some the attitudes. *Yellow, orange & green* were rated as quite *positive* and neither *hard* nor *soft*.

2. *Purple* and *Brown*. These two basic colours tend to be clustered together which indicates that they have parallel attitude associations within the *lightness-purity* factor. Regarding the patterns of the ratings in the semantic differential chart of *purple & brown*, it was seen that these colours were rated more substantially by using the right poles more than the left poles of 15 attitude scales (see Figure 6.8). That is to say, the participants construed these colours by considering the negative poles of the attitude scales within this factor. These two basic colours had also some overlapping ratings on some of the attitudes, i.e. *purple & brown* were rated as quite *suffocating*, slightly *impure*, quite *complex*, and slightly *insincere.*

As a consequence, it can be concluded that, the basic colours *yellow, orange & green* and *purple & brown* are perceived as more identical than the other basic colours by the participants within the *lightness-purity* factor.

With respect to the cluster analysis, the strongest associations among eleven basic colours within the *evaluation* factor are; *black, green, white & orange*; and *yellow, purple & blue*. These results indicate that the degrees of the associations of each of three attitudes within this factor to each of these clustered basic colours are parallel. Each of these colour clusters are discussed in the following.

1. *Black, Green, White* and *Orange*. These four basic colours tend to clustered together which indicates that they share similar attitude associations with the *evaluation* factor. Concerning the patterns of the ratings in the semantic differential chart of *black, green, white & orange*, it was seen that these colours were rated more considerably by using the left poles more than the right poles of three attitude scales (see Figure 6.10). This means that, the participants construed these colours by considering the positive poles of the attitude scales within this factor. Although there were relatively small differences of the patterns of the ratings of these four colours, they were rated as slightly *beautiful*, slightly *modern* and slightly *attractive*.

2. *Yellow*, *Purple* and *Blue*. These three basic colours cluster together which indicates that they have similar attitude relations within the *evaluation* factor. Regarding the patterns of the ratings in the semantic differential chart of *yellow, purple & blue*, it was seen that these colours were rated more substantially by using the midpoint of three rating scales rather than by using the left or right poles of three attitude scales (see Figure 6.11). That is to say, the participants construed these colours by considering the expression of 'neither-nor' of the attitudes within this factor except the attitude scale *modern-traditional*. While *purple* and *blue* were rated as neither *modern* nor *traditional*, *yellow* was rated as slightly *traditional*.

As a consequence, it can be concluded that, the basic colours *black, green, white & orange* and *yellow, and purple & blue* are perceived as more identical than the other basic colours by the participants within the *evaluation* factor.

With regard to the cluster analysis, the strongest associations among eleven basic colours within the *familiarity* factor are; *yellow & green*; *brown & blue*; and *pink & purple*. These results indicate that the degrees of the associations of each of four attitudes within this factor to each of these clustered basic colours are parallel. Each of these colour clusters are discussed in the following.

1. *Yellow* and *Green*. These two basic colours cluster together which indicates that they share similar attitude associations within the *familiarity* factor. Concerning the patterns of the ratings in the semantic differential chart of *yellow & green* (see Figure 6.13), it was seen that these colours were rated more considerably by using the left poles more than the right poles of four attitude scales. This means that, the participants construed these colours by considering the positive poles of the attitude scales within this factor. The participants rated *yellow & green* on the attitude scales *familiar-unfamiliar* and *common-rare* by considering them as neither *familiar* nor *unfamiliar* and neither *common* nor *rare*.

2. *Brown* and *Blue*. These two basic colours tend to be clustered together which indicates that they have similar attitude relations within the *familiarity* factor. Regarding the patterns of the ratings in the semantic differential chart of *brown & blue* (see Figure 6.14), it was seen that these colours were rated more substantially by using the left poles more than the right poles of four attitude scales. In other words, the participants construed these colours by considering the positive poles of the attitude scales within this factor. Additionally, *brown & blue* had some overlapping ratings on some of the attitudes, i.e. these two basic colours were rated as quite *natural* and slightly *strong*.

3. *Pink* and *Purple*. These two basic colours tend to be clustered together which indicates that they share similar attitude associations within the *familiarity* factor. As regards the patterns of the ratings in the semantic differential chart of *pink & purple*, it was seen that these colours were rated more considerably by using the right poles more than the left poles of four attitude scales (see Figure 6.15). That is to say, the participants construed these colours by considering the negative poles of the attitude scales within this factor. The overlapping ratings on some the attitudes are as follows. They were rated as slightly *unfamiliar* and slightly *rare* by the participants.

As a consequence, it can be concluded that, the basic colours *yellow & green*, *brown &* blue, and *pink & purple* are perceived as more identical than the other basic colours by the participants within the *familiarity* factor.

7.1.4.3 Discussions on the Relationships between the Attitudes and Eleven Basic Colours within Each Four Factor

For the third step of analyses of the fourth objective, one sample t-test was performed to investigate the relationships between eleven basic colours and the attitudes within each four factor. One sample t-test was preferred to use for two main purposes. First, it was used to determine which of the attitudes were perceived as significantly important by the participants over the other attitudes for each basic colour. Second, it was used to determine which of the poles of the attitude scales were perceived as significant for the participants while they were construing each basic colour. The purpose is to support general conclusions of the ways in which the participants think of, construe and give meaning to eleven basic colours. Table 7.2 presents the list of the shared attitudes by the participants towards eleven basic colours within each four factor.

In regard of the results of one sample t-test, eleven basic colours elicit both positive and negative attitudes. For reminding purposes, the left poles of the attitude scales were considered as positive poles, whereas, the right poles of the attitude scales were considered as negative poles. The positive and negative relations of each attitude of each basic colour are displayed by a plus sign (i.e. '+') and a minus sign (i.e. '-'), respectively in Table 7.2. Some basic colours are significantly associated with several different attitudes and some attitudes are significantly associated with more than one basic colour. These significant associations of eleven basic colours with the positive and negative attitudes are discussed within each four factor, i.e. *activity*, *lightness-purity*, *evaluation*, and *familiarity*, separately in the following.

1. Relations between Eleven Basic Colours and the Attitudes within A*ctivity* Factor:

Harmoniousness is found to be the most significant positive attitude in construing black, grey and white. This indicates that the achromatic colours are perceived as harmonious. In addition to this, brown is also construed as harmonious. Besides harmoniousness, these achromatic colours are also seen as soothing. In accordance, pink, brown and blue are perceived as soothing as well. Regarding the results of one sample t-test, being soothing is found to be the most significant positive attitude in perceiving brown and blue. In addition to be seen as soothing, blue is also seen as expressive and conspicuous. Besides the achromatic colours reveal the attitude of being soothing, black is perceived as dominant and white as bright. Valdez (1994) reports in a study on achromatic colours that, the highest level of dominance is elicited by the colour black. He reports further, the bright colours like whites and light colours are less dominant than the less bright colours like blacks and dark colours. The findings of the present research are in agreement with those of Valdez (1994). Additionally, the darker colours are associated with greater dominance is expressed by Valdez (1994), as well. In accordance, like black, purple and red are also perceived as dominant. Beyond the colours black and red, the results show that, dominancy is the most significant positive attitude in perceiving purple.

Table 7.2 The list of shared attitudes towards eleven basic colours within each four factor

Black	Grey	White	Yellow	Orange	Red	Pink	Purple	Brown	Blue	Green
					Activity Factor					
harmonious (+)	harmonious (+)	harmonious (+)	cheerful (+)	frivolous (+)	warm (+)	frivolous (+)	dominant (+)	soothing (+)	soothing (+)	alive (+)
dominant (+)	soothing (+)	bright (+)	energetic (+)	energetic (+)	vivid (+)	soothing (+)	sad (-)	harmonious (+)	expressive (+)	frivolous (+)
soothing (+)	inanimate (-)	soothing (+)	dynamic (+)	alive (+)	aggressive (+)	charming (+)	disharmonious (-)	warm (+)	conspicuous (+)	cheerful (+)
solemn (-)	inconspicuous (-)	calm* (-)	bright (+)	vivid (+)	dominant (+)	warm (+)		boring (-)	calm* (-)	bright (+)
sad (-)	static (-)		alive (+)	entertaining (+)	expressive (+)	cheerful (+)		passive (-)	cool (-)	vivid (+)
static (-)	dim (-)		active (+)	exciting (+)	conspicuous (+)	calm* (-)		dim (-)	calm† (-)	disharmonious (-)
inanimate (-)			warm (+)	active (+)	dynamic (+)	disharmonious (-)				cool (-)
passive (-)			disturbing (-)	cheerful (+)	energetic (+)	dim (-)				disturbing (-)
			disharmonious (-)	warm (+)	disturbing (-)					
				disturbing (-)	solemn (-)					
				disharmonious (-)	disharmonious (-)					
					Lightness-Purity Factor					
heavy (+)	mature (+)	innocent (+)	cheering (+)	cheering (+)	hard (+)	innocent (+)	heavy (+)	heavy (+)	dark (-)	optimistic (+)
mature (+)	clear (+)	clean (+)	optimistic (+)	innocent (+)	heavy (+)	light[a] (+)	mature (+)	mature (+)	immature (-)	positive (+)
hard (+)	light[a] (+)	light[a] (+)	light[a] (+)	positive (+)	optimistic (+)	restful (+)	complex (-)	hard (+)	light[b] (-)	pure (+)
dark** (-)	gloomy (-)	luminous (+)	innocent (+)	clean (+)	restless (-)	luminous (+)	dark** (-)	complex (-)		cheering (+)
dark†† (-)	dirty (-)	clear (+)	immature (-)	immature (-)	dark** (-)	optimistic (+)		gloomy (-)		refreshing (+)
gloomy (-)	pessimistic (-)	pure (+)	light[b] (-)			positive (+)		dark** (-)		immature (-)
suffocating (-)		refreshing (+)				soft (-)				light[b] (-)
negative (-)		light[b] (-)				immature (-)				
		soft (-)								
		immature (-)								
					Evaluation Factor					
	repulsive (-)				attractive (+)					
					Familiarity Factor					
strong (+)	artificial (-)		natural (+)		strong (+)			familiar (+)		natural (+)
artificial (-)										

* opposite of aggressive
** opposite of light
[a] opposite of dark
† opposite of energetic
†† opposite of luminous
[b] opposite of heavy

On the other hand, the negative attitudes in perceiving the achromatic colours in terms of their statistical significance are as follows. Black is seen as solemn, sad, static, inanimate and passive. Grey is seen as inanimate, inconspicuous, static and dim. White is perceived as calm. With respect to the results of one sample t-test, like black, red is perceived as solemn as well. Sadness is found to be the most significant negative attitude in perceiving purple. In addition to the colour grey, pink is also construed as dim, whereas brown is perceived as both passive and dim. Being boring is found to be the most significant negative attitude in construing brown. As white, calmness is found to be the most significant negative attitude in perceiving both the colours pink and blue. Although calmness assumes to be indicative of the positive quality of the colours, within the activity factor, it is positioned at the negative poles of the attitude scales *aggressive-calm* and *energetic-calm* and, therefore, it is considered as negative. Wright and Rainwater (1962, p. 96) find in a study on the meanings of colours that, "[…] the darker or the more blue is a colour; the more it connotes […] calmness." The findings of the present research are in some way in line with those of Wright and Rainwater (1962); however, in some way they are not consistent with those of these authors. For instance, blue is seen as calm and also as dark (see the *lightness-purity* factor) which is in agreement with those findings. However, white and pink are perceived as light (opposite of dark) (see the *lightness-purity* factor), although they are construed as calm. In accordance with this finding, it can be concluded that, calmness accepts to be indicative of the important quality of the light colours, as well.

Kaya and Epps (2004) state that, the temperature terms like warm or cool can also be used to describe the colours which are related to the wavelength of the colour. Valdez and Mehrabian (1994) claim that, long-wavelength colours, i.e. red, orange and yellow, are considered as warm and short-wavelength colours, i.e. blue and green, and are considered as cool. The findings of the present research are in agreement with the statement of Valdez and Mehrabian (1994) that, coolness is the most significant negative attitude in construing blue and green. Again, coolness assumes to be indicative of the positive quality of these colours, within the activity factor, it is placed at the negative pole of the attitude scale *warm-cool* and, therefore, it is considered as negative. On the other hand, the results show that, the colours yellow, orange and red are perceived as warm as in the statement. In addition, pink and brown are also seen as warm, this is because, pink has 70% resemblance to red, and brown has 40% resemblance to yellow and 60% resemblance to red. However, warmth is found to be the most significant positive attitude only in perceiving the colour red. Cheerfulness and frivolousness are found to be the most significant positive attitudes towards the colours yellow and orange, respectively. D'Andrade and Egan (1974) suggest that, the emotional associations are not only based on the actual hue or the wavelength of the colours but their degree of saturation and lightness. They propose further as follows.

> […] If some "yellow" object seems to be a cheerful color, it is not because of the yellow *hue* of the object, but because the color of the object is light and saturated. A dark and unsaturated yellow does not seem cheerful. If a very saturated, very light purple could be found, we believe it would seem as cheerful as "yellow" (p. 62).

In accordance with the assumption of the aforementioned authors, it may be considered to be valid for the colour orange which is found to be perceived as frivolous, as well as cheerful. According to the theory of D'Andrade and Egan (1974), while very light colours would seem as cheerful as yellow, it can be assumed that very light colours would be as frivolous as orange. Regarding the results of one sample t-test, frivolousness is found to be the most significant positive attitude in perceiving pink. Additionally, it is seen as cheerful, as well. D'Andrade and Egan (1974) suggest further that, the colour green is felt to be restful, this is because, it is considered as unsaturated colour. However, the present research finds that, green is also perceived as frivolous and cheerful. The reason for this is possibly be that, Şahin Ekici et al. (2006) report in a study on colour naming, responses of Turkish people for green are more on the GY (green-yellow) pages of the Munsell Color System than the page G (green). This indicates the green colour that corresponds with its name precisely according to Turkish people is green-yellow. Therefore, the colour that was utilised for the experiment has 70% resemblance to green and 30% resemblance to yellow (NCS S 1080-G30Y). Having yellow colour in

green might have resulted in being perceived as frivolous and cheerful. Moreover, aliveness is found to be the most significant positive attitude in construing green. It is also perceived as bright and vivid. In addition to be perceived as warm, yellow is seen as energetic, dynamic, bright, alive, and active; orange is seen as energetic, alive, vivid, entertaining, exciting and active; red is seen as vivid, aggressive, expressive, conspicuous, dynamic and energetic. These findings support what Valdez and Mehrabian (1994) state as long-wavelength colours are more arousing than short-wavelength colours. Although this statement is true for blue, according to the findings of the present research, it is not accurate for the colour green.

Although long-wavelength colours have high arousal, being disturbing is found to be the most significant negative attitude in construing yellow, orange, and red. Like long-wavelength colours, green is also seen as disturbing. While disharmoniousness is the most significant negative attitude in perceiving green, it is the next significant negative attitude in ranking towards yellow, orange and red. Additionally, pink and purple are seen as disharmonious as well. Consequently, it can be concluded that, yellow, orange and red are perceived as warm and tend to be seen as disturbing and disharmonious, whereas green is perceived as cool and tend to be seen as disturbing and disharmonious.

2. Relations between Eleven Basic Colours and the Attitudes within *Lightness-Purity* Factor:

The results of one sample t-test obtained in the present research suggest that, heaviness is found to be the most significant positive attitude in construing the colours black, purple, brown and red as well. Although hardness is the most significant positive attitude towards the colour red, it is found that red is also perceived as heavy which is next in ranking after being perceived as hard. Brown is also seen as hard which may be the reason of having 60% resemblance to red. In addition to red and brown, black is seen as hard, as well. Heaviness and hardness, nevertheless, assume to be indicative of the negative quality of the colours, within the *lightness-purity* factor, it is positioned at the positive poles of the attitude scales *heavy-light* and *hard-soft*, respectively. Therefore, they are considered as positive. The findings on Pearson's product-moment correlations of the attitudes within the *lightness-purity* factor show that, the colours which are construed as heavy tend also to be perceived as dark (opposite of light). The scale heavy-light is only associated with the colour dimension of lightness, is expressed by Ou et al. (2004a). The findings of the present research are in some way in line with that of Ou et al. (2004a); however, in some way they are not in consistent with the finding of these authors. One sample t-test confirms that, the colours black, purple, brown and red are perceived as heavy which are at the same time seen as dark. Darkness is the most significant negative attitude in construing the colour blue which is also seen as light (opposite of heavy). Lightness (opposite of heaviness) is found to be the most significant negative attitude in construing white which is also seen as light (opposite of heavy). Although lightness seems to be the indicative of the positive quality of the colours, it is considered as negative within this factor. These findings of the present research are in line with Ou et al.'s (2004a) statement. On the other hand, it is found that, yellow and green are perceived as light (opposite of heavy), as well. These colours are in their full chroma, therefore it can be suggested that, heaviness or lightness of colours are not associated with the colour dimension of lightness only, but are related also with the colour dimensions of brightness and saturation.

The short-wavelength colours, i.e. blue and green, are perceived as light (opposite of heavy) and they are seen as immature as well. Like green, immaturity is found to be the most significant negative attitude in perceiving yellow and orange. In accordance, white and pink are also perceived as immature. On the other hand, black, purple and brown are seen as mature. Regarding these findings, it can be suggested that, while the lighter and brighter colours are thus perceived as immature, the darker colours are perceived as mature. However, this assumption is not accurate for the colour grey. This is because; although grey is perceived as light (opposite of dark), maturity is found to be the most significant positive attitude in construing it. Gloominess is the most significant negative attitude in perceiving grey and this is followed by dirtiness and pessimism in ranking. Like

grey, black and brown are also seen as gloomy. Furthermore, while black is construed as suffocating and negative, brown is perceived as dirty, dark (opposite of luminous) and suffocating. Complexity is found to be the most significant negative attitude in perceiving purple and brown. On the other hand, grey and white are construed as clear colours. Hogg et al. (1979) suggest that, the colours which are in medium value are seen as complex and the colours that have low chroma but low or high value are seen as simple (or clear). As distinct from Hogg et al. (1979), the present research indicates that, the darker colours are seen as complex and the colours which are very light or in medium value are seen as clear. It is agreed with the aforementioned authors that, complexity and clearness have linear relationship with the colour dimension of lightness.

Restlessness is found to be the most significant negative attitude in construing the colour red, however, it is also perceived as optimistic. In accordance, optimism is found to be the most significant positive attitude in perceiving green. It is also perceived as positive, pure, cheering and refreshing. Like red and green, pink and yellow are also seen as optimistic. Pink is also seen as light (opposite of heavy), restful, luminous and positive; however, softness is found to be the most significant attitude in perceiving it. White is also seen as soft, as well as light (opposite of dark), luminous, pure and refreshing. Moreover, innocence of white and pink are found to be the most important positive attitudes in construing these basic colours. Cleanness is the second most important positive attitude towards white. In accordance with these colours, the long-wavelength colours, i.e. yellow and orange but not red, are also perceived as innocent. Like white, orange is seen as clean. The results show that, being cheering is the most significant positive attitude in perceiving the long-wavelength colours except red. Additionally, while orange is seen as positive, yellow is perceived as light (opposite of dark).

3. Relations between Eleven Basic Colours and the Attitudes within *Evaluation* Factor:

With respect to the results of one sample t-test, only the mean scores of two out of eleven basic colours are found to be statistically significant within three attitude scales of the *evaluation* factor. The results indicate that, attractiveness is the most significant positive attitude in construing the colour red. On the other hand, repulsiveness is found to be the most significant negative attitude in perceiving grey. Hogg (1969) reports in a study that, the evaluation factor is associated with the colour dimension of brightness. The findings about the colours red and grey in the present research are in agreement with that of Hogg (1969). Red is perceived as attractive, this is because it is bright and saturated. Whereas, grey is perceived as repulsive, this is because it is less bright and unsaturated. Beyond these two basic colours, no additional attitudes either positive or negative are found significant over the other attitudes for the rest of the basic colours.

4. Relations between Eleven Basic Colours and the Attitudes within *Familiarity* Factor:

In regard of the results one sample t-test, only the mean scores of six out eleven basic colours are found to be statistically significant within four attitude scales of the *familiarity* factor. The results indicate that, strength is the most significant positive attitude in construing the colours black and red. The scale *strong-weak* characterises the dimensions of potency, forcefulness, strength and dominance in the studies of Osgood et al. (1957), Wright and Rainwater (1962), Hogg (1969), Sivik (1974a), and Valdez and Mehrabian (1994); however, as already been stated, it is grouped under the factor of *familiarity* with a lowest loading. Valdez and Mehrabian (1994) report in a study that, the darker or less bright colours elicit feelings of strength. Wright and Rainwater (1962) state that, greater saturation corresponds with great forcefulness. Hogg (1969) confirms this by reporting that, forcefulness is related to the value of a colour and the darker and more saturated colours tend to be more forceful. The findings of the present research are in line with those of these aforementioned authors and their statements clarify why black and red is perceived as strong. Furthermore, artificiality is found to be the most significant negative attitude in perceiving black and grey. In other words, these two achromatic colours are perceived as artificial. On the other hand, naturalness is

found to be the most significant positive attitude in construing yellow and green. That is to say, yellow and green are natural colours. In accordance, brown is found to be the most familiar colour over the other basic colours within the *familiarity* factor.

To summarise the relative attitudes generally shared for eleven basic colours:

- **Black** is harmonious, dominant, soothing, solemn, sad, static, inanimate, passive; heavy, mature, hard, dark (opposite of light), dark (opposite of luminous), gloomy, suffocating, negative; strong, artificial.

- **Grey** is harmonious, soothing, inanimate, inconspicuous, static, dim; mature, clear, light (opposite of dark), gloomy, dirty, pessimistic; repulsive; artificial.

- **White** is harmonious, bright, soothing, calm (opposite of aggressive); innocent, clean, light (opposite of dark), luminous, clear, pure, refreshing, light (opposite of heavy), soft, immature.

- **Yellow** is cheerful, energetic, dynamic, bright, alive, active, warm, disturbing, disharmonious; cheering, optimistic, light (opposite of dark), innocent, immature, light (opposite of heavy); natural.

- **Orange** is frivolous, energetic, alive, vivid, entertaining, exciting, active, cheerful, warm, disturbing, disharmonious; cheering, innocent, positive, clean, immature.

- **Red** is warm, vivid, aggressive, dominant, expressive, conspicuous, dynamic, energetic, disturbing, solemn, disharmonious; hard, heavy, optimistic, restless, dark (opposite of light); attractive; strong.

- **Pink** is frivolous, soothing, charming, warm, cheerful, calm (opposite of aggressive), disharmonious; innocent, light (opposite of dark), restful, luminous, optimistic, positive, soft, immature.

- **Purple** is dominant, sad, disharmonious; heavy, mature, complex, dark (opposite of light).

- **Brown** is soothing, harmonious, warm, boring, passive, dim; heavy, mature, hard, complex, gloomy, dark (opposite of light); familiar.

- **Blue** is soothing, expressive, conspicuous, calm (opposite of aggressive), cool, calm (opposite of energetic); dark, immature, light (opposite of heavy).

- **Green** is alive, frivolous, cheerful, bright, vivid, disharmonious, cool, disturbing; optimistic, positive, pure, cheering, refreshing, immature, light (opposite of heavy); natural.

In conclusion, it is important to point out that, the research which has been described in this thesis is first and foremost exploratory. The reliability of the elicited data has been found to be consistently high and adequate. The findings from the present research have provided that, the obtained results are accurate. In accordance, the results of the factor analysis have indicated the construct validity. In other words, construct validity of the data have been assessed by utilising factor analysis. Although the measurement instrument and the findings of the research have provided reasonably reliable and valid quantitative data, there have been some limitations which are discussed in the following.

7.2 Limitations of the Research

The research has several limitations. One limitation of this research concerns the participants who attended the experiment. The experiment was carried out with Turkish participants living in Turkey

who were the undergraduate students of METU Faculty of Architecture. These students are considered as a homogenous subject group for the experiment. However, the population size is limited to 60 participants and the data collected represents only a portion of the responses in the population of Turkish culture. Therefore, these provide restrictions to make generalizability of the conclusions. The findings of this research, however, suggest certain information for further scientific investigations in addition to those of the previous studies on colour perception and colour psychology.

Second limitation of this research concerns the colours that were utilised as stimuli in the experiment. The perceived colours that were used in the experiment were eleven basic colour categories. These colours are considered as universal basic colour terms by Berlin and Kay (1969). It was believed in terms of this research that, these eleven basic colour categories subsume all possible colours with which people perceive their surroundings. However, as the experiment was conducted with Turkish participants living in Turkey, one problem of these eleven basic categories was which of each basic colour corresponded with its name mostly or precisely according to the perceiver was of great importance. Therefore, Şahin Ekici et al.'s (2006) research on 'Color Naming' was utilised to select the basic colours for the experiment because the aforesaid study was conducted with six cities located in different regions of Turkey. The selected basic colours from Şahin Ekici et al.'s (2006) study indicate that, each basic colour is corresponded with its name precisely according to Turkish people. Therefore, this provides restrictions to make generalizability of the conclusions on the ways in which the individuals construe eleven basic colours. Additionally, these eleven basic colours provide restrictions to understand the relationships between the individuals' attitudes and the colour appearance attributes, i.e. hue, lightness, and saturation/chroma. This is because the findings of this research indicate only the colour attribute of hue more than lightness and chroma. Another limitation is the colour samples that were used to elicit the participants' personal attitudes towards eleven basic colours in the experiment. Norman and Scott (1952) state that the studies that use colour samples in order for the respondent's affective responses to colours to be measured; they actually measure the responses to colour samples. Although the colour samples or patches have been widely used in the studies on connotative meanings (Sivik, 1974a) and emotional associations of colours (Ou, 2004) by the researchers, as regards the statement of Norman and Scott (1952), the use of colour samples in the experiment should also be accepted as one of the limitations of the present research. However, the findings should have practical contributions to designers who utilise colour samples in their initial colour decisions in the design process. In addition to the colour samples, the research concerns the sample size (i.e. A6=148 x 105 mm) of the colours used in the experiment. This is because increasing the size of the colour samples can change the participants' perception and the ways of construing the same eleven basic colours.

Another important limitation of this research concerns the interview technique that was utilised to elicit the ways in which the participants think of, construe and give meaning to eleven basic colours in their own words. The RGT is an open and flexible technique which involves a considerable amount of effort to be considered both from the participants as well as from the researcher through the course of the attitude elicitation procedure. Beyond this, the personal attitudes towards the perceived colours elicited from 60 participants that constituted 60 individual repertory grid data of this research had substantially a great amount of information to be analysed both semantically and statistically. This indicates the researcher to spend a significant amount of effort to make analyses of the obtained data. The research concerns the qualitative content analysis of the elicited repertory grids which were based on reviewing the elicited words in Turkish and translating them into English without losing their underlying meanings according to the linguistic and semantic grounds. In order to prevent the participants to be saturated and bored during the elicitation interview and to reduce the amount of data elicited, it should be suggested to limit the number of idiosyncratic/personal attitudes elicited rather than to leave the interview open-ended. By this way, the elicited attitudes should be analysed more easily. The other limitation is that, although 102 common attitudes were elicited, only 42 of them were found to be reliable to apply multivariate statistical methods. The remaining 60 common attitudes elicited had to be eliminated to be analysed quantitatively.

However, it is likely that to increase the population size of the experiment might result in eliciting more attitudes which might be collated with these 60 common attitudes and analysed accordingly.

7.3 Suggestions for the Further Research

As the result of the research, a total of 102 attitude scales were obtained. These scales were regarded as the most pertinent representations of the individuals' ways of construing and giving meaning to the perceived colours. Although these obtained attitude scales were a kind of semantic differential devised by Osgood et al. (1957), in accordance with the underlying theory and assumptions of the RGT, they were based on the idiographic views of the individuals towards the perceived colours. In other words, what was of great significance of this research was that, the methodical approach which was the RGT allowed the participants to create their own semantic differentials in their own words and to give relevant semantic scales to rate the colours in turn. Therefore, these obtained scales can be used as a measurement tool for the psychometric tests. However, due to the limitation of time, the obtained set of attitude scales were not possible to be developed in order to be used as a measurement tool in colour studies. In this regard, further research thus will be needed for the item-pool generation of the attitudes, scale development and scale evaluation.

The participants who attended the experiment were the undergraduate students of Industrial Design and Architecture. As regards the colour education in their education progress, the students have an acquaintance with colour, colour theory, colour harmony principles and its aesthetic value. The elicited attitudes thus more or less were related to the students' background knowledge about colour, although the experiment had no expectations of the participants having any knowledge about colour. However, in the case of design and architecture students, the knowledge about colour theory and its application principles become unavoidable. The further work therefore will be needed to conduct an experiment with the participation of non-designers and non-architects in order for the differences of the attitudes elicited towards the perceived colours between two subject groups to be investigated. In light of such differences, more cross-validation studies with the subject groups from different nationalities are recommended. These will provide interesting results and will address the question of whether there are universal ways in which the individuals think of, construe and give meaning to colours.

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APPENDIX A

ELEVEN COROLLARIES OF PERSONAL CONSTRUCT PSYCHOLOGY

The Appendix A gives the eleven elaborative corollaries with their definitions of the personal construct psychology. The definitions of the corollaries are quoted directly from Kelly's (1955/1991, pp. 35-66) book of '*The psychology of personal constructs, volume one: The theory of personality'.*

1. **Construction corollary:** A person anticipates events by construing their replications (see Section 2.6).

2. **Individuality corollary:** Persons differ from each other in their construction of events (see Section 2.6).

3. **Organisation corollary:** Each person characteristically evolves, for their convenience in anticipating events, a construction system embracing ordinal relationships between constructs.

4. **Dichotomy corollary:** A person's construction system is composed of a finite number of dichotomous constructs.

5. **Choice corollary:** Persons choose for themselves that alternative in a dichotomised construct through which they anticipate the greater possibility for the elaboration of their system.

6. **Range corollary:** A construct is convenient for the anticipation of a finite range of events only.

7. **Experience corollary:** A person's construction system varies as they successively construe the replication of events.

8. **Modulation corollary:** The variation in a person's construction system is limited by the permeability of the constructs within whose range of convenience the variants lie.

9. **Fragmentation corollary:** A person may successively employ a variety of construction subsystems which are inferentially incompatible with each other.

10. **Commonality corollary:** To the extent that one person employs a construction of experience which is similar to that employed by another; their processes are psychologically similar to those of the other person (see Section 2.6).

11. **Sociality corollary:** To the extent that one person construes the construction processes of another; they may play a role in a social process involving the other person.

APPENDIX B

DEMOGRAPHIC FEATURES OF THE PARTICIPANTS

Table B.1 The demographic features of the participants

Participant	Age	Gender	Department*	Year	Interview Time (in minutes)	Number of Dyads	Number of Elicited Bipolar Attitudes
01	22	Female	ID	4th	28	5	9
02	22	Male	ID	4th	31	5	9
03	24	Female	ID	4th	30	5	9
04	21	Female	ID	3rd	47	3	12
05	22	Female	ID	4th	40	4	9
06	23	Female	ID	4th	54	3	18
07	27	Female	ID	4th	41	3	11
08	22	Female	ID	4th	29	4	12
09	23	Male	ID	3rd	39	3	11
10	23	Male	ID	4th	44	5	12
11	23	Male	ID	4th	38	4	12
12	22	Female	ID	4th	40	4	14
13	23	Female	ID	4th	34	5	13
14	23	Female	ID	4th	33	4	10
15	22	Female	ID	4th	25	3	7
16	25	Female	ID	4th	31	4	8
17	22	Male	ID	4th	60	4	11
18	23	Female	ID	4th	29	3	10
19	23	Female	ID	4th	45	4	16
20	21	Female	ID	3rd	34	5	10
21	23	Female	ID	4th	30	6	10
22	21	Male	ID	2nd	23	3	7
23	21	Male	ID	2nd	25	3	7
24	23	Female	ID	3rd	26	5	9
25	23	Male	ID	3rd	40	3	9
26	22	Female	ID	3rd	37	3	12
27	21	Female	ID	2nd	35	4	12
28	23	Female	ID	3rd	24	3	9
29	21	Female	ID	3rd	26	4	10
30	22	Female	ID	3rd	33	4	12
31	22	Female	ID	3rd	35	5	14
32	23	Female	ID	3rd	33	3	9
33	24	Female	ID	3rd	31	4	10
34	21	Female	ID	3rd	29	3	10
35	23	Male	ID	3rd	36	5	10
36	21	Male	ARCH	2nd	23	4	7
37	20	Female	ARCH	2nd	25	4	9
38	22	Male	ARCH	2nd	34	4	14
39	21	Male	ARCH	3rd	37	2	11

Table B.1 (cont'd).

Participant	Age	Gender	Department*	Year	Interview Time (in minutes)	Number of Dyads	Number of Elicited Bipolar Attitudes
40	23	Male	ARCH	3rd	23	3	13
41	25	Male	ARCH	4th	36	4	10
42	24	Male	ARCH	4th	20	4	8
43	22	Male	ARCH	4th	27	4	11
44	21	Male	ARCH	2nd	19	5	8
45	22	Male	ARCH	4th	40	5	10
46	21	Male	ARCH	2nd	26	4	7
47	21	Female	ARCH	2nd	25	5	10
48	22	Female	ARCH	2nd	19	3	6
49	23	Male	ARCH	2nd	20	3	7
50	21	Male	ARCH	2nd	31	4	11
51	21	Male	ARCH	2nd	20	4	12
52	21	Male	ARCH	2nd	20	3	8
53	21	Male	ARCH	3rd	41	4	13
54	24	Male	ARCH	4th	31	3	11
55	20	Female	ARCH	4th	42	3	14
56	24	Male	ARCH	3rd	19	2	6
57	22	Male	ARCH	3rd	19	3	6
58	23	Male	ARCH	3rd	25	4	9
59	23	Male	ARCH	3rd	30	4	10
60	24	Male	ARCH	3rd	32	4	9

* ID : Industrial Design

ARCH : Architecture

APPENDIX C

1ST AND 2ND TYPE OF GRID FORMATS

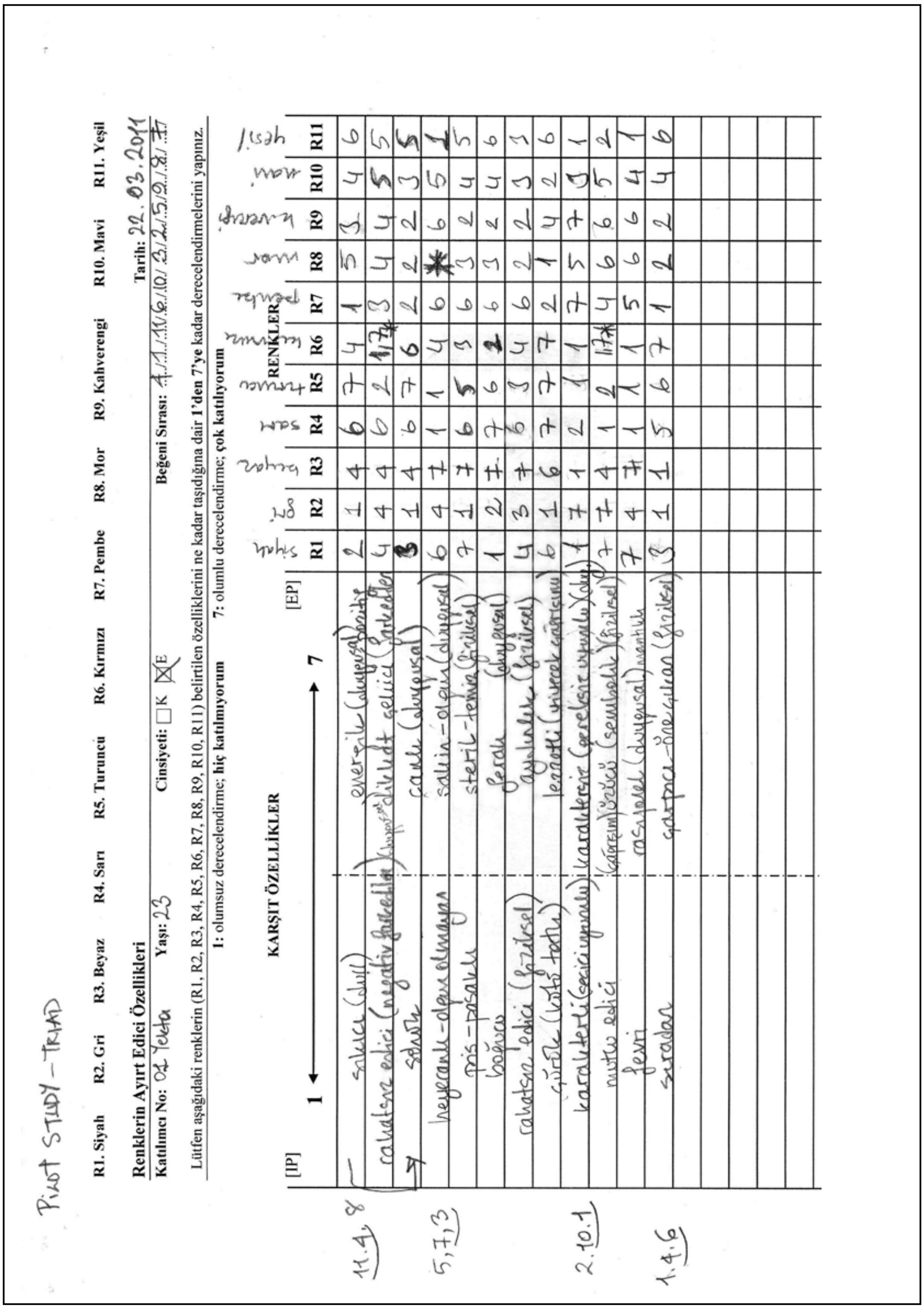


Figure C.1 1st type of grid format

Pilot Study - Dyad

R1. Siyah **R2. Gri** **R3. Beyaz** **R4. Sarı** **R5. Turuncu** **R6. Kırmızı** **R7. Pembe** **R8. Mor** **R9. Kahverengi** **R10. Mavi** **R11. Yeşil**

Renklerin Ayırt Edici Özellikleri **Tarih:** 24.03.2011

Katılımcı No: 04 **Yaşı:** 27 **Cinsiyeti:** ☐K ☒E **Beğeni Sırası:** ~~4./6./10./3./2./1./9./11./5./8./7.~~

Lütfen aşağıdaki renklerin (R1, R2, R3, R4, R5, R6, R7, R8, R9, R10, R11) belirtilen özelliklerini ne kadar taşıdığına dair **1'den 7'ye** kadar derecelendirmelerini yapınız.

1: olumsuz derecelendirme; **hiç katılmıyorum** **7:** olumlu derecelendirme; **çok katılıyorum**

KARŞIT ÖZELLİKLER

[IP] **1** ⟷ **7** [EP]

RENKLER

	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	
3.7 art niyet	1	4	~~7~~	5	5	5	~~7~~	4	2	5	6	sağlık - masumiyet (duygusal)
kirli	1	2	~~7~~	6	5	5	~~7~~	3	1	4	6	tehlike (çağrışımsal - fonksiyonel)
masculine	4	4	4	5	5	4	~~7~~	~~7~~	4	3	5	feminen (kültürel çağrışım)
2.6 baslum	3	~~7~~	6	~~1~~	2	~~1~~	5	2	6	3	2	etkisiz - nötr (fiziksel)
sıradan - olağan	4	~~1~~	6	~~7~~	6	~~7~~	2	6	~~1~~	4	6	çarpıcı - dikkat çekici (çağrışımsal) (fiziksel)
dynamic	~~7~~	~~7~~	2	~~1~~	~~1~~	~~1~~	6	4	~~7~~	2	3	static (çağrışım)
10.11 yapay	~~1~~	~~1~~	~~7~~	~~7~~	5	5	2	2	~~7~~	~~7~~	~~7~~	doğal (çağrışım)
pasif	~~1~~	~~1~~	2	~~7~~	6	~~7~~	~~1~~	4	~~1~~	6	~~7~~	aktif (çağrışım)
uyumsuz	6	~~7~~	4	4	4	2	~~1~~	2	4	~~7~~	2	uyumlu (duygusal)
9.8 canlı	6	~~7~~	~~1~~	~~1~~	2	~~1~~	5	5	~~1~~	3	2	canlı - ölü (duygusal) çağrışım. çürük yiyecekle çağrışımı duruma var.

Figure C.2 2nd type of grid format

APPENDIX D

TURKISH EXPLANATION OF THE DYADIC PROCEDURE OF THE EXPERIMENT

Table D.1 Turkish explanation of the dyadic procedure of the experiment

Bu bir mülakattır. Bu çalışma, bu on bir temel rengi (izleme kabini içinde yer alan) kendi cümleleriniz ile nasıl yorumladığınızı ve anlamlaştırdığınızı belirlemek üzerinedir. Bu nedenle, söz konusu renkleri nasıl algıladığınızı anlayabilmek için, kişisel yaklaşımlarınızı bulmam gerekmektedir. Bunu, izleme kabini içerisinde bir çift rengi bir seferde sunarak ve bu iki rengin benzer ya da farklı olup olmadıklarını sorarak yapacağım. Benzer ya da farklı olduklarını belirledikten sonra, size bu iki rengi benzer ya da farklı kılanın ne olduğunu ve hangi nitelikleri bu iki rengi benzer ya da farklı yaptıklarını soracağım. Renk çiftini benzer ya da farklı olarak değerlendirmeniz, bu iki rengin fiziksel özelliklerinden kaynaklanabileceği gibi sizde hatırlattıkları ya da çağrıştırdıkları ve/ya da size özel bazı anlamları ve/ya da açığa çıkardığı duygu ile ilinti olabilir. Sizden beklenen ise, sunulan renk çiftini tüm bu tutumlar doğrultusunda kelimeler ya da sıfatlar şeklinde iletmenizdir. Tutumlarınızı sözlü olarak açığa çıkarırken, ben de bu sırada söylediklerinizi tablonun sağ ucuna not edeceğim. Daha sonra, açığa çıkardığınız kelimelerin ya da sıfatların karşıt anlamlarının neler olduğunu soracağım ve karşıt anlamlarını da tablonun sol ucuna not edeceğim. Bu sayede, on bir rengi birbirinden ayırt etmek için kullanılacak olan çift kutuplu kişisel tutumlarınızın listesini elde etmiş olacağım. Devamında, tüm bu on bir rengi gözlem kabinine yerleştireceğim ve açığa çıkarmış olduğunuz kişisel tutumlarınıza göre her bir rengi sırasıyla 1'den 7'ye kadar derecelendirmenizi isteyeceğim. Renkleri nasıl derecelendireceğinizi daha sonra detaylı olarak değerlendirme aşamasında açıklayacağım. Değerlendirme aşamısının tamamlanmasının ardından, izleme kabini içerisine başka bir çift rengi bir seferde sunacağım ve aynı süreç tarafınızdan herhangi yeni bir tutum sunulamayana kadar tekrar edecektir. Bu mülakatta zaman sınırı yoktur. Sıkıldığınızda ya da yorulduğunuzda mülakatı sonlandırabilirsiniz. Mülakat boyunca size bazı sorular sorarak yönlendireceğim. Doğru cevaplarını aramıyorum sadece sunulan iki rengi nasıl yorumladğınızla ilgileniyorum ve tamamen size özgüdür. Bu on bir rengi, herhangi bir, örneğin, maviler ya da kırmızılar ya da pembeler ya da yeşiller ve vesaire olarak hayal etmeden size göründükleri gibi yorumlamanızı istiyorum. Son olarak, sunulan iki rengi hem aynı hem de farklı olarak görebilirsiniz, dolayısıyla hem benzer hem de farklı olarak belirtmekte serbestsiniz.

APPENDIX E

EXTRACTED TRANSCRIPT OF THE INTERVIEW OF P29 FOR THE FIRST DYAD IN TURKISH

Table E.1 The extracted transcript of the interview of P29 for the first dyad in Turkish

	İLK ÇİFT: SİYAH & YEŞİL
A:	"Size göre bu iki renk benzer midir ya da farklı mıdır?"
K:	"Farklılar."
A:	"Bu iki renk niçin farklı? Ya da sizce bu iki rengi farklı kılan nedir?"
P:	"**Parlaklık** diyebilirim. Kesinlikle siyahta öyle birşey yok ama yeşil siyaha göre daha parlak. Aynı zamanda farklı hisler veriyorlar. Siyah çok **karamsar** ve yeşil siyaha göre daha çok **enerji** veriyor.
R:	"Burada söylemek istediğiniz enerjik karamsarın karşıtı olduğu mudur? Ya da enerjiği başka bir tutum olarak ele almamı mı istersiniz?"
P:	"Hayır, bence **iyimser** karamsarın karşıtı. Bu nedenle, enerjik başka bir tutum olarak ele alınmalıdır."
R:	"Hangi niteliğinden dolayı yeşili parlak olarak düşünüyorsunuz?"
P:	"Bence fiziksel niteliği nedeniyle."
R:	"Öyleyse parlağın karşıtı size göre ne olur?"
P:	"Muhtemelen **sönük** olur."
R:	"Daha önce belirtiğiniz üzere, karamsarı duygusal bir nitelik olarak alıyorum. Öyleyse hangi niteliğinden dolayı yeşili enerjik olarak düşünüyorsunuz?"
P:	"Çünkü parlak."
R:	"Enerjiğin karşıtı size göre ne olur?"
P:	"Muhtemelen **statik** olur."
R:	"Dolayısıyla statiği enerjiğin karşıtı bir tutum olarak ele alıyorum. Şu var ki, sanırım ne demek istediğinizi anlıyorum, sadece emin olmak için, enerjik diyerek neyi kastediyorsunuz? Rica etsem aklınızda olanı tanımlamaya çalışır mısınız?"
P:	"Aslında, siyah beni durduruyor gibi ama yeşil beni hareketlendiriyor. Bence yeşilin **dinamik** olduğunu kastediyorum."
R:	"Öyleyse, söylemeye çalıştığınız yeşil enerjikten ziyade dinamik ve siyahın ise statik olduğudur."
P:	"Evet."

Table E.1 (cont'd).

R:	"Başka herhangi bir farklılıkları var mıdır?"
P:	"Aklımda bu iki renk hakkında söylemek istediğim başka birşey yok."
R:	"Tamam, teşekkür ederim. Sıradaki çiftliye geçmeden önce, bu iki renkle açığa çıkarmış olduğunuz düşünceleri unutmamanız için, bu on bir rengi, kendinizin elde etmiş olduğu çift kutuplu tutumlarınızla yedi puanlık ölçeğe göre sırasıyla derecelendirmenizi istiyorum. Lütfen her bir rengi ölçeğin hangi ucuna yakın olduğunu söyleyerek, 1, 2, 3, 4, 5, 6 ya da 7 sayılarından birini veriniz. Mesela; en uç noktalarını tanımlayan, sol kutupdaki 'sönük' ölçek sonunun '1' ve sağ kutuptaki 'parlak' ölçek sonunun '7' olduğunu gösteriyor. Ölçeğin ortasındaki '4' ise 'ne sönük ne de parlak' ifadesine sahiptir. '2' ve '3' sayıları sol kutupdaki 'sönük' sıfatını sırasıyla 'oldukça' ve 'biraz' ve '6' ve '5'sayıları sağ kutuptaki 'parlak' sıfatını sırasıyla 'oldukça' ve 'biraz' ifadeleriyle temsil ediyor. Buna göre, siyahı nasıl derecelendirirsiniz?"
P:	"Siyahı diğer renklerle karşılaştırdığımda mı."
R:	"Hayır, her rengi bağımsız olarak ele almanızı istiyorum."
P:	"Bence siyah '2' alır."
R:	"Buna göre, her bir rengi sırasıyla derecelendirmenizi istiyorum."

APPENDIX F

COMMON BIPOLAR ATTITUDES IN TURKISH AND THEIR TRANSLATIONS IN ENGLISH

Table F.1 The common bipolar attitudes in Turkish and their translations in English

No.	Turkish	English
1	doğal-yapay	natural-artificial
2	parlak-sönük	bright-dim
3	uyumlu-uyumsuz	harmonious-disharmonious
4	açık-koyu	light-dark
5	baskın-çekinik	dominant-recessive
6	dinamik-statik	dynamic-static
7	sıcak-soğuk	warm-cool
8	göze çarpan-farkedilmeyen	conspicuous-inconspicuous
9	enerjik-sakin	energetic-calm
10	aydınlık-karanlık	luminous-dark
11	olgun-olgun olmayan	mature-immature
12	sevimli-sevimsiz	charming-charmless
13	canlı-cansız	alive-inanimate
14	çekici-itici	attractive-repulsive
15	temiz-kirli	clean-dirty
16	neşeli-üzgün	cheerful-sad
17	rahatlatıcı-rahatsız edici	soothing-disturbing
18	iç açıcı-iç karartıcı	cheering-gloomy
19	canlı-soluk	vivid-pale
20	sert-yumuşak	hard-soft
21	ağır-hafif	heavy-light
22	pozitif-negatif	positive-negative
23	aktif-pasif	active-passive
24	iyimser-karamsar	optimistic-pessimistic
25	eğlenceli-sıkıcı	entertaining-boring
26	erkeksi-kadınsı	masculine-feminine
27	alışıldık-alışılmadık	familiar-unfamiliar
28	yaygın-nadir	common-rare
29	ferah-boğucu	refreshing-suffocating
30	modern-geleneksel	modern-traditional
31	uçarı-oturaklı	frivolous-solemn
32	güçlü-zayıf	strong-weak
33	heyecanlandırıcı-rahatlatıcı	exciting-calming
34	huzurlu-huzursuz	restful-restless
35	ifadeli-ifadesiz	expressive-unexpressive
36	saf-saf olmayan	pure-impure
37	samimi-samimiyetsiz	sincere-insincere
38	salgırgan-ılımlı	aggressive-calm
39	masum-kötü niyetli	innocent-malicious
40	net-karışık	clear-complex

Table F.1 (cont'd).

No.	Turkish	English
41	sıradışı-sıradan	extraordinary-ordinary
42	güzel-çirkin	beautiful-ugly
43	dinlendirici-yorucu	relaxing-tiresome
44	gerçekçi-hayalsi	realistic-fanciful
45	karakterli-karaktersiz	characterful-characterless
46	çarpıcı-solgun	remarkable-dull
47	zarif-zarafetsiz	elegant-inelegant
48	tutkulu-donuk	passionate-dull
49	motive edici-depresif	motivating-depressing
50	sonlu-sonsuz	finite-infinite
51	dolu-boş	filled-blank
52	genç-yaşlı	young-old
53	derin-yüzeysel	deep-superficial
54	temel-ilave	elemental-supplemental
55	güvenli-tehlikeli	safe-dangerous
56	özgür-hapsedilmiş	free-confined
57	dışadönük-içedönük	extroverted-introverted
58	iyi-kötü	good-bad
59	gösterişli-gösterişsiz	spectacular-unspectacular
60	yoğun-seyrek	dense-sparse
61	dünyevi-ruhani	earthly-spiritual
62	var-yok	existent-absent
63	varolan-yokolan	existent-evanescent
64	sesli-sessiz	audible-silent
65	sınırdaki-merkezdeki	marginal-centremost
66	yakın-uzak	near-far
67	lezzetli-lezzetsiz	appetising-unappetising
68	pürüzlü-pürüzsüz	rough-smooth
69	resmi-resmi olmayan	formal-informal
70	güvenilir-güvenilmez	reliable-unreliable
71	opak-transparan	opaque-transparent
72	dikkat çekici-dikkat dağıtıcı	striking-distracting
73	enerji verici-yorucu	energising-tiresome
74	narin-kaba	delicate-robust
75	ön planda-arka planda	foreground-background
76	geçişken-ayrık	transitional-discrete
77	hızlı-yavaş	fast-slow
78	seksi-çocuksu	sexy-childish
79	korkutucu-şirin	frightening-cute
80	bütün-ufalanmış	whole-detrital
81	alakalı-alakasız	compatible-incompatible
82	esnek-katı	flexible-rigid

Table F.1 (cont'd).

No.	Turkish	English
83	ilham verici-sıkıcı	inspirational-unexciting
84	uslu-yaramaz	obedient-mischievous
85	zararsız-tehditkar	harmless-threatening
86	doğurgan-kısır	fertile-barren
87	farkında-unutulmuş	aware-forgotten
88	naif-kibirli	naive-arrogant
89	cesaretli-çekingen	courageous-timid
90	homojen-heterojen	homogenous-heterogeneous
91	vazgeçilen-vazgeçilmeyen	dispensable-indispensable
92	apaçık-gizemli	apparent-mysterious
93	taze-bayat	fresh-stale
94	heybetli-minyon	gigantic-tiny
95	tekil-çoğul	single-plural
96	öznel-nesnel	objective-subjective
97	organik-organik olmayan	organic-inorganic
98	mülayim-hırslı	mild-ambitious
99	bağımlı-bağımsız	dependent-independent
100	somut-soyut	concrete-abstract
101	başarılı-başarısız	successful-unsuccessful
102	barışçı-savaşçı	peaceful-martial

APPENDIX G

LIST OF COMMON ELICITED BIPOLAR ATTITUDES

Table G.1 The list of common bipolar attitudes

No.	Common Attitude	N=60 n	N=60 %	Type of Bipolarity	Type of Response Attribute
1	natural-artificial	32	53%	opposition	connotation
2	bright-dim	27	45%	opposition	physical
3	harmonious-disharmonious	26	43%	negation	physical
4	light-dark	24	40%	opposition	physical
5	dominant-recessive	21	35%	opposition	physical
6	dynamic-static	21	35%	opposition	emotion
7	warm-cool	20	33%	opposition	physical
8	conspicuous-inconspicuous	18	30%	negation	physical
9	energetic-calm	17	28%	non-contiguous	emotion
10	luminous-dark	16	27%	opposition	physical
11	mature-immature	15	25%	negation	connotation
12	charming-charmless	14	23%	negation	emotion
13	alive-inanimate	14	23%	opposition	emotion
14	attractive-repulsive	14	23%	opposition	emotion
15	clean-dirty	12	20%	opposition	connotation
16	cheerful-sad	12	20%	opposition	connotation
17	soothing-disturbing	12	20%	opposition	emotion
18	cheering-gloomy	11	18%	opposition	emotion
19	vivid-pale	10	17%	opposition	physical
20	hard-soft	10	17%	opposition	connotation
21	heavy-light	9	15%	opposition	connotation
22	positive-negative	9	15%	opposition	emotion
23	active-passive	9	15%	opposition	emotion
24	optimistic-pessimistic	9	15%	opposition	emotion
25	entertaining-boring	8	13%	opposition	emotion
26	masculine-feminine	8	13%	opposition	meaning
27	familiar-unfamiliar	8	13%	negation	connotation
28	common-rare	7	12%	opposition	connotation
29	refreshing-suffocating	7	12%	non-contiguous	emotion
30	modern-traditional	7	12%	non-contiguous	meaning
31	frivolous-solemn	7	12%	opposition	emotion
32	strong-weak	6	10%	opposition	emotion
33	exciting-calming	6	10%	opposition	emotion
34	restful-restless	6	10%	negation	emotion
35	expressive-unexpressive	6	10%	negation	emotion
36	pure-impure	6	10%	negation	emotion
37	sincere-insincere	6	10%	negation	emotion

Table G.1 (cont'd).

No.	Common Attitude	N=60 n	N=60 %	Type of Bipolarity	Type of Response Attribute
38	aggressive-calm	6	10%	opposition	emotion
39	innocent-malicious	5	8%	non-contiguous	emotion
40	clear-complex	5	8%	opposition	physical
41	extraordinary-ordinary	5	8%	opposition	meaning
42	beautiful-ugly	5	8%	opposition	connotation
43	relaxing-tiresome	4	7%	non-contiguous	emotion
44	realistic-fanciful	4	7%	opposition	emotion
45	characterful-characterless	4	7%	negation	emotion
46	remarkable-dull	4	7%	non-contiguous	emotion
47	elegant-inelegant	4	7%	negation	emotion
48	passionate-dull	3	5%	non-contiguous	emotion
49	motivating-depressing	3	5%	opposition	emotion
50	finite-infinite	3	5%	negation	emotion
51	filled-blank	3	5%	opposition	emotion
52	young-old	3	5%	opposition	connotation
53	deep-superficial	3	5%	opposition	connotation
54	elemental-supplemental	3	5%	non-contiguous	meaning
55	safe-dangerous	3	5%	opposition	connotation
56	free-confined	3	5%	opposition	connotation
57	extroverted-introverted	3	5%	opposition	emotion
58	good-bad	3	5%	opposition	emotion
59	spectacular-unspectacular	2	3%	negation	emotion
60	dense-sparse	2	3%	opposition	emotion
61	earthly-spiritual	2	3%	opposition	connotation
62	existent-absent	2	3%	opposition	emotion
63	existent-evanescent	2	3%	non-contiguous	emotion
64	audible-silent	2	3%	non-contiguous	emotion
65	marginal-centremost	2	3%	opposition	meaning
66	near-far	2	3%	opposition	emotion
67	appetising-unappetising	2	3%	negation	connotation
68	rough-smooth	2	3%	opposition	connotation
69	formal-informal	2	3%	negation	connotation
70	reliable-unreliable	2	3%	negation	connotation
71	opaque-transparent	2	3%	opposition	connotation
72	striking-distracting	1	2%	non-contiguous	emotion
73	energising-tiresome	1	2%	opposition	emotion
74	delicate-robust	1	2%	opposition	connotation
75	foreground-background	1	2%	opposition	physical
76	transitional-discrete	1	2%	non-contiguous	physical
77	fast-slow	1	2%	opposition	meaning
78	sexy-childish	1	2%	non-contiguous	connotation

Table G.1 (cont'd).

No.	Common Attitude	N=60 n	%	Type of Bipolarity	Type of Response Attribute
79	frightening-cute	1	2%	non-contiguous	emotion
80	whole-detrital	1	2%	non-contiguous	connotation
81	compatible-incompatible	1	2%	negation	emotion
82	flexible-rigid	1	2%	opposition	emotion
83	inspirational-unexciting	1	2%	non-contiguous	emotion
84	obedient-mischievous	1	2%	opposition	emotion
85	harmless-threatening	1	2%	non-contiguous	emotion
86	fertile-barren	1	2%	opposition	connotation
87	aware-forgotten	1	2%	non-contiguous	connotation
88	naive-arrogant	1	2%	non-contiguous	emotion
89	courageous-timid	1	2%	opposition	emotion
90	homogenous-heterogeneous	1	2%	opposition	physical
91	dispensable-indispensable	1	2%	negation	connotation
92	apparent-mysterious	1	2%	opposition	emotion
93	fresh-stale	1	2%	opposition	connotation
94	gigantic-tiny	1	2%	opposition	emotion
95	single-plural	1	2%	opposition	physical
96	objective-subjective	1	2%	opposition	emotion
97	organic-inorganic	1	2%	negation	connotation
98	mild-ambitious	1	2%	non-contiguous	emotion
99	dependent-independent	1	2%	negation	connotation
100	concrete-abstract	1	2%	opposition	emotion
101	successful-unsuccessful	1	2%	negation	emotion
102	peaceful-martial	1	2%	opposition	emotion

APPENDIX H

CHI-SQUARE GOODNESS OF FIT TEST FOR GENDER DIFFERENCES

Table H.1 The chi-square goodness of fit test for gender differences

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	10,963[a]	4	0.027
Likelihood Ratio	11.619	4	0.020
Linear-by-Linear Association	1.828	1	0.176
N of Valid Cases	60		

a. 2 cells (20.0%) have expected count less than 5. The minimum expected count is 3.50.

APPENDIX I

ROTATED COMPONENT MATRIX OF SIX FACTOR SOLUTIONS

Table I.1 The rotated component matrix of six factor solutions

Rotated Component Matrix[a]

	Component					
	1	2	3	4	5	6
exciting-calming	0.976					
energetic-calm	0.964					
soothing-disturbing	-0.932					
dynamic-static	0.928					
active-passive	0.922					
alive-inanimate	0.917					
vivid-pale	0.902					
charming-charmless	0.879					
conspicuous-inconspicuous	0.857					
cheerful-sad	0.842					
warm-cool	0.837					
entertaining-boring	0.783					
bright-dim	0.761					
frivolous-solemn	0.725					
harmonious-disharmonious	-0.722					
dominant-recessive	0.695					
aggressive-calm	0.647					
extraordinary-ordinary	0.574					
heavy-light		-0.972				
innocent-malicious		0.945				
light-dark		0.945				
luminous-dark		0.943				
refreshing-suffocating		0.935				
pure-impure		0.917				
restful-restless		0.885				
clean-dirty		0.878				
hard-soft		-0.833				
clear-complex		0.826				
positive-negative		0.818				
optimistic-pessimistic		0.762				
sincere-insincere		0.756				
cheering-gloomy		0.719				
mature-immature		-0.667				
attractive-repulsive			0.814			
expressive-unexpressive			0.789			
strong-weak			0.679			
familiar-unfamiliar				0.901		
common-rare				0.793		
natural-artificial				0.789		
masculine-feminine		**-0.505**		**0.527**		
modern-traditional					0.958	
beautiful-ugly					0.685	

Extraction Method: Principle Component Analysis.

Rotation Method: Varimax with Kaizer Normalisation.

a. Rotation converged in 10 iterations.

APPENDIX J

ROTATED COMPONENT MATRIX OF FIVE FACTOR SOLUTIONS

Table J.1 The rotated component matrix of five factor solutions

Rotated Component Matrix[a]

	Component				
	1	2	3	4	5
exciting-calming	0.964				
vivid-pale	0.961				
energetic-calm	0.960				
dynamic-static	0.948				
soothing-disturbing	-0.932				
active-passive	0.928				
conspicuous-inconspicuous	0.927				
charming-charmless	0.912				
alive-inanimate	0.908				
warm-cool	0.899				
dominant-recessive	0.820				
entertaining-boring	0.812				
cheerful-sad	0.806				
bright-dim	0.790				
aggressive-calm	0.735				
harmonious-disharmonious	-0.691				
frivolous-solemn	0.665				
expressive-unexpressive	0.634				
extraordinary-ordinary	0.614				
heavy-light		-0.983			
light-dark		0.955			
innocent-malicious		0.948			
refreshing-suffocating		0.943			
luminous-dark		0.942			
pure-impure		0.902			
restful-restless		0.888			
clean-dirty		0.859			
hard-soft		-0.840			
clear-complex		0.838			
positive-negative		0.829			
optimistic-pessimistic		0.758			
cheering-gloomy		0.730			
sincere-insincere		0.723			
mature-immature		-0.689			
beautiful-ugly			0.913		
modern-traditional			0.820		
attractive-repulsive			0.706		
familiar-unfamiliar				0.895	
natural-artificial				0.800	
common-rare				0.743	
strong-weak				0.531	

Extraction Method: Principle Component Analysis.

Rotation Method: Varimax with Kaizer Normalisation.

a. Rotation converged in 10 iterations.

APPENDIX K

AGGLOMERATION SCHEDULES OF ELEVEN BASIC COLOURS WITHIN EACH FOUR FACTOR

Table K.1 The agglomeration schedule of eleven basic colours within activity factor

Agglomeration Schedule

	Cluster Combined			Stage Cluster First Appears		
Stage	Cluster 1	Cluster 2	Coefficients	Cluster 1	Cluster 2	Next Stage
1	4	5	5.705	0	0	5
2	3	10	10.535	0	0	6
3	2	9	12.246	0	0	8
4	7	8	18.765	0	0	6
5	4	11	19.206	1	0	7
6	3	7	27.439	2	4	9
7	4	6	30.692	5	0	10
8	1	2	33.926	0	3	9
9	1	3	52.142	8	6	10
10	1	4	140.325	9	7	0

Table K.2 The agglomeration schedule of eleven basic colours within lightness-purity factor

Agglomeration Schedule

	Cluster Combined			Stage Cluster First Appears		
Stage	Cluster 1	Cluster 2	Coefficients	Cluster 1	Cluster 2	Next Stage
1	4	11	8.491	0	0	3
2	8	9	8.807	0	0	6
3	4	5	9.909	1	0	4
4	4	10	18.278	3	0	5
5	4	7	22.501	4	0	8
6	6	8	22.585	0	2	7
7	2	6	28.151	0	6	9
8	3	4	40.651	0	5	10
9	1	2	42.407	0	7	10
10	1	3	111.593	9	8	0

Table K.3 The agglomeration schedule of eleven basic colours within evaluation factor

Agglomeration Schedule

	Cluster Combined			Stage Cluster First Appears		
Stage	Cluster 1	Cluster 2	Coefficients	Cluster 1	Cluster 2	Next Stage
1	1	11	.060	0	0	3
2	3	5	.127	0	0	3
3	1	3	.277	1	2	6
4	4	8	.694	0	0	5
5	4	10	.890	4	0	6
6	1	4	1.792	3	5	8
7	7	9	3.306	0	0	10
8	1	2	3.531	6	0	9
9	1	6	5.407	8	0	10
10	1	7	14.543	9	7	0

Table K.4 The agglomeration schedule of eleven basic colours within familiarity factor

Agglomeration Schedule

	Cluster Combined			Stage Cluster First Appears		
Stage	Cluster 1	Cluster 2	Coefficients	Cluster 1	Cluster 2	Next Stage
1	4	11	.274	0	0	5
2	9	10	.590	0	0	4
3	7	8	1.222	0	0	6
4	3	9	1.911	0	2	7
5	4	6	3.063	1	0	7
6	5	7	4.126	0	3	9
7	3	4	8.514	4	5	8
8	1	3	10.319	0	7	10
9	2	5	13.198	0	6	10
10	1	2	16.855	8	9	0

APPENDIX L

ONE SAMPLE T-TEST OF ELEVEN BASIC COLOURS WITHIN EACH FOUR FACTOR

Table L.1 The results of one sample t-test of eleven basic colours within activity factor

	BLACK :: Test Value = 4.83						
						95% Confidence Interval of the Difference	
Attitude	t	df	Sig. (2-tailed)	Mean	Mean Difference	Lower	Upper
exciting-calming	2.27	5	0.073	6.00	1.170	-0.157	2.497
vivid-pale	-0.89	9	0.399	4.20	-0.630	-2.240	0.980
energetic-calm	1.75	16	0.100	5.41	0.582	-0.124	1.287
dynamic-static	**5.61**	**20**	**0.000**	**6.29**	1.456	0.914	1.997
active-passive	**2.87**	**8**	**0.021**	**6.00**	1.170	0.229	2.111
conspicuous-inconspicuous	-1.16	17	0.263	4.28	-0.552	-1.559	0.454
soothing-disturbing	**-3.61**	**11**	**0.004**	**3.08**	-1.747	-2.812	-0.681
alive-inanimate	**4.36**	**13**	**0.001**	**6.21**	1.384	0.698	2.070
charming-charmless	0.05	13	0.965	4.86	0.027	-1.271	1.325
warm-cool	0.30	19	0.764	4.95	0.120	-0.704	0.944
entertaining-boring	0.48	7	0.648	5.25	0.420	-1.664	2.504
dominant-recessive	**-5.22**	**20**	**0.000**	**2.48**	-2.354	-3.294	-1.414
cheerful-sad	**5.07**	**11**	**0.000**	**6.42**	1.587	0.898	2.275
bright-dim	1.34	26	0.193	5.30	0.466	-0.252	1.184
harmonious-disharmonious	**-5.55**	**25**	**0.000**	**2.46**	-2.368	-3.248	-1.489
frivolous-solemn	**14.19**	**6**	**0.000**	**6.86**	2.027	1.678	2.377
aggressive-calm	-0.88	5	0.421	3.83	-0.997	-3.921	1.928
extraordinary-ordinary	-0.20	4	0.853	4.60	-0.230	-3.468	3.008
expressive-unexpressive	-1.63	5	0.165	3.00	-1.830	-4.723	1.063

Table L.1 (cont'd).

	GREY :: Test Value = 5.52						
						95% Confidence Interval of the Difference	
Attitude	t	df	Sig. (2-tailed)	Mean	Mean Difference	Lower	Upper
exciting-calming	0.26	5	0.803	5.67	0.147	-1.287	1.580
vivid-pale	0.54	9	0.604	5.70	0.180	-0.578	0.938
energetic-calm	0.98	16	0.343	5.76	0.245	-0.286	0.776
dynamic-static	**3.18**	**20**	**0.005**	**6.29**	0.766	0.264	1.267
active-passive	1.02	8	0.338	6.00	0.480	-0.607	1.567
conspicuous-inconspicuous	**2.79**	**17**	**0.013**	**6.33**	0.813	0.198	1.428
soothing-disturbing	**-5.74**	**11**	**0.000**	**2.67**	-2.853	-3.948	-1.758
alive-inanimate	**6.09**	**13**	**0.000**	**6.57**	1.051	0.678	1.425
charming-charmless	-0.88	13	0.397	5.14	-0.377	-1.307	0.553
warm-cool	1.09	19	0.291	5.80	0.280	-0.259	0.819
entertaining-boring	-0.23	7	0.823	5.38	-0.145	-1.623	1.333
dominant-recessive	1.88	20	0.074	6.05	0.528	-0.057	1.112
cheerful-sad	0.97	11	0.351	5.83	0.313	-0.395	1.022
bright-dim	**2.60**	**26**	**0.015**	**6.07**	0.554	0.116	0.992
harmonious-disharmonious	**-10.99**	**25**	**0.000**	**2.31**	-3.212	-3.814	-2.610
frivolous-solemn	1.10	6	0.314	6.00	0.480	-0.588	1.548
aggressive-calm	-0.38	5	0.721	5.33	-0.187	-1.458	1.084
extraordinary-ordinary	1.39	4	0.237	6.20	0.680	-0.680	2.040
expressive-unexpressive	0.48	5	0.652	5.83	0.313	-1.368	1.995

Table L.1 (cont'd).

	WHITE :: Test Value = 4.28						
						95% Confidence Interval of the Difference	
Attitude	t	df	Sig. (2-tailed)	Mean	Mean Difference	Lower	Upper
exciting-calming	2.13	5	0.086	5.33	1.053	-0.218	2.324
vivid-pale	-0.12	9	0.907	4.20	-0.080	-1.581	1.421
energetic-calm	1.19	16	0.250	4.82	0.544	-0.422	1.509
dynamic-static	0.28	20	0.783	4.43	0.149	-0.962	1.260
active-passive	1.04	8	0.331	4.89	0.609	-0.747	1.965
conspicuous-inconspicuous	-0.22	17	0.832	4.17	-0.113	-1.222	0.995
soothing-disturbing	**-2.45**	**11**	**0.032**	**3.00**	-1.280	-2.429	-0.131
alive-inanimate	0.75	13	0.466	4.71	0.434	-0.815	1.684
charming-charmless	-0.88	13	0.394	3.93	-0.351	-1.213	0.510
warm-cool	1.79	19	0.089	4.95	0.670	-0.111	1.451
entertaining-boring	0.15	7	0.883	4.38	0.095	-1.383	1.573
dominant-recessive	-0.09	20	0.932	4.24	-0.042	-1.049	0.965
cheerful-sad	-0.84	11	0.421	3.83	-0.447	-1.622	0.729
bright-dim	**-4.56**	**26**	**0.000**	**2.67**	-1.613	-2.341	-0.886
harmonious-disharmonious	**-6.07**	**25**	**0.000**	**2.12**	-2.165	-2.899	-1.430
frivolous-solemn	1.56	6	0.170	5.14	0.863	-0.491	2.217
aggressive-calm	**3.48**	**5**	**0.018**	**6.17**	1.887	0.492	3.282
extraordinary-ordinary	1.87	4	0.135	5.40	1.120	-0.546	2.786
expressive-unexpressive	-1.01	5	0.358	3.00	-1.280	-4.532	1.972

Table L.1 (cont'd).

	YELLOW :: Test Value = 2.73						
						95% Confidence Interval of the Difference	
Attitude	t	df	Sig. (2-tailed)	Mean	Mean Difference	Lower	Upper
exciting-calming	-1.88	5	0.119	1.83	-0.897	-2.124	0.330
vivid-pale	-1.62	9	0.139	2.20	-0.530	-1.269	0.209
energetic-calm	**-4.22**	**16**	**0.001**	**1.65**	-1.083	-1.626	-0.539
dynamic-static	**-4.30**	**20**	**0.000**	**1.81**	-0.920	-1.367	-0.474
active-passive	**-3.09**	**8**	**0.015**	**2.11**	-0.619	-1.081	-0.157
conspicuous-inconspicuous	-0.80	17	0.437	2.39	-0.341	-1.246	0.564
soothing-disturbing	**10.44**	**11**	**0.000**	**5.83**	3.103	2.449	3.758
alive-inanimate	**-2.65**	**13**	**0.020**	**1.86**	-0.873	-1.584	-0.162
charming-charmless	-1.05	13	0.315	2.29	-0.444	-1.362	0.474
warm-cool	**-2.36**	**19**	**0.029**	**2.20**	-0.530	-1.000	-0.060
entertaining-boring	0.24	7	0.819	2.88	0.145	-1.299	1.589
dominant-recessive	-0.35	20	0.732	2.62	-0.111	-0.778	0.556
cheerful-sad	**-7.43**	**11**	**0.000**	**1.33**	-1.397	-1.811	-0.983
bright-dim	**-4.94**	**26**	**0.000**	**1.81**	-0.915	-1.296	-0.535
harmonious-disharmonious	**9.64**	**25**	**0.000**	**5.27**	2.539	1.997	3.082
frivolous-solemn	-2.25	6	0.065	2.14	-0.587	-1.225	0.051
aggressive-calm	2.46	5	0.057	4.00	1.270	-0.057	2.597
extraordinary-ordinary	1.52	4	0.204	4.00	1.270	-1.053	3.593
expressive-unexpressive	1.11	5	0.317	3.67	0.937	-1.231	3.104

Table L.1 (cont'd).

	ORANGE :: Test Value = 2.34						
						95% Confidence Interval of the Difference	
Attitude	t	df	Sig. (2-tailed)	Mean	Mean Difference	Lower	Upper
exciting-calming	**-3.19**	**5**	**0.024**	**1.67**	-0.673	-1.215	-0.131
vivid-pale	**-3.35**	**9**	**0.009**	**1.60**	-0.740	-1.240	-0.240
energetic-calm	**-5.74**	**16**	**0.000**	**1.47**	-0.869	-1.190	-0.548
dynamic-static	-1.91	20	0.071	1.90	-0.435	-0.911	0.040
active-passive	**-2.86**	**8**	**0.021**	**1.67**	-0.673	-1.217	-0.130
conspicuous-inconspicuous	-0.21	17	0.838	2.28	-0.062	-0.696	0.572
soothing-disturbing	**7.43**	**11**	**0.000**	**5.25**	2.910	2.048	3.772
alive-inanimate	**-4.14**	**13**	**0.001**	**1.50**	-0.840	-1.279	-0.401
charming-charmless	-0.60	13	0.559	2.14	-0.197	-0.908	0.514
warm-cool	**-3.47**	**19**	**0.003**	**1.80**	-0.540	-0.866	-0.214
entertaining-boring	**-2.72**	**7**	**0.030**	**1.63**	-0.715	-1.337	-0.093
dominant-recessive	-0.24	20	0.816	2.29	-0.054	-0.535	0.426
cheerful-sad	**-2.63**	**11**	**0.023**	**1.67**	-0.673	-1.237	-0.109
bright-dim	-1.92	26	0.065	1.96	-0.377	-0.780	0.026
harmonious-disharmonious	**7.27**	**25**	**0.000**	**4.65**	2.314	1.658	2.970
frivolous-solemn	**-5.72**	**6**	**0.001**	**1.29**	-1.054	-1.506	-0.603
aggressive-calm	2.01	5	0.101	3.33	0.993	-0.278	2.264
extraordinary-ordinary	0.91	4	0.415	3.40	1.060	-2.178	4.298
expressive-unexpressive	0.82	5	0.449	2.83	0.493	-1.051	2.038

Table L.1 (cont'd).

	RED :: Test Value = 2.46						
						95% Confidence Interval of the Difference	
Attitude	t	df	Sig. (2-tailed)	Mean	Mean Difference	Lower	Upper
exciting-calming	-1.15	5	0.300	1.83	-0.627	-2.022	0.768
vivid-pale	**-7.59**	**9**	**0.000**	**1.30**	-1.160	-1.506	-0.814
energetic-calm	**-2.59**	**16**	**0.020**	**1.94**	-0.519	-0.944	-0.094
dynamic-static	**-2.33**	**20**	**0.030**	**1.90**	-0.555	-1.052	-0.059
active-passive	-1.47	8	0.180	1.78	-0.682	-1.754	0.390
conspicuous-inconspicuous	**-3.58**	**17**	**0.002**	**1.78**	-0.682	-1.084	-0.280
soothing-disturbing	**6.08**	**11**	**0.000**	**5.50**	3.040	1.940	4.140
alive-inanimate	-0.92	13	0.375	2.14	-0.317	-1.063	0.429
charming-charmless	-0.47	13	0.645	2.29	-0.174	-0.973	0.624
warm-cool	**-9.84**	**19**	**0.000**	**1.25**	-1.210	-1.467	-0.953
entertaining-boring	-0.67	7	0.524	2.25	-0.210	-0.951	0.531
dominant-recessive	**-5.54**	**20**	**0.000**	**1.48**	-0.984	-1.354	-0.613
cheerful-sad	1.79	11	0.101	3.00	0.540	-0.124	1.204
bright-dim	0.94	26	0.356	2.67	0.207	-0.246	0.659
harmonious-disharmonious	**4.21**	**25**	**0.000**	**4.15**	1.694	0.865	2.523
frivolous-solemn	**3.01**	**6**	**0.024**	**4.29**	1.826	0.343	3.309
aggressive-calm	**-5.34**	**5**	**0.003**	**1.33**	-1.127	-1.669	-0.585
extraordinary-ordinary	1.50	4	0.207	4.20	1.740	-1.474	4.954
expressive-unexpressive	**-2.81**	**5**	**0.038**	**1.50**	-0.960	-1.838	-0.082

Table L.1 (cont'd).

	PINK :: Test Value = 4.23						
						95% Confidence Interval of the Difference	
Attitude	t	df	Sig. (2-tailed)	Mean	Mean Difference	Lower	Upper
exciting-calming	0.54	5	0.610	4.67	0.437	-1.627	2.500
vivid-pale	0.10	9	0.919	4.30	0.070	-1.440	1.580
energetic-calm	1.70	16	0.109	4.76	0.535	-0.134	1.203
dynamic-static	0.33	20	0.743	4.33	0.103	-0.546	0.752
active-passive	0.52	8	0.617	4.56	0.326	-1.118	1.769
conspicuous-inconspicuous	1.83	17	0.085	4.89	0.659	-0.102	1.420
soothing-disturbing	**-5.05**	**11**	**0.000**	**2.92**	-1.313	-1.885	-0.741
alive-inanimate	1.38	13	0.192	4.93	0.699	-0.398	1.796
charming-charmless	**-2.17**	**13**	**0.049**	**3.14**	-1.087	-2.170	-0.004
warm-cool	**-2.65**	**19**	**0.016**	**3.45**	-0.780	-1.396	-0.164
entertaining-boring	-0.37	7	0.724	4.00	-0.230	-1.712	1.252
dominant-recessive	2.07	20	0.052	4.76	0.532	-0.005	1.069
cheerful-sad	-2.53	11	0.028	3.50	-0.730	-1.365	-0.095
bright-dim	2.51	26	0.019	4.81	0.585	0.106	1.064
harmonious-disharmonious	**2.84**	**25**	**0.009**	**4.88**	0.655	0.179	1.130
frivolous-solemn	**-7.23**	**6**	**0.000**	**2.00**	-2.230	-2.985	-1.475
aggressive-calm	**3.41**	**5**	**0.019**	**5.67**	1.437	0.353	2.521
extraordinary-ordinary	0.25	4	0.814	4.40	0.170	-1.713	2.053
expressive-unexpressive	-0.06	5	0.951	4.17	-0.063	-2.583	2.457

Table L.1 (cont'd).

	PURPLE :: Test Value = 4.23						
						95% Confidence Interval of the Difference	
Attitude	t	df	Sig. (2-tailed)	Mean	Mean Difference	Lower	Upper
exciting-calming	-0.08	5	0.936	4.17	-0.063	-1.989	1.862
vivid-pale	-1.45	9	0.182	3.70	-0.530	-1.359	0.299
energetic-calm	0.24	16	0.814	4.29	0.064	-0.504	0.632
dynamic-static	1.22	20	0.238	4.57	0.341	-0.245	0.927
active-passive	0.22	8	0.832	4.33	0.103	-0.984	1.190
conspicuous-inconspicuous	-0.18	17	0.860	4.17	-0.063	-0.812	0.685
soothing-disturbing	-0.41	11	0.690	4.08	-0.147	-0.935	0.641
alive-inanimate	1.46	13	0.169	4.86	0.627	-0.303	1.557
charming-charmless	-0.03	13	0.976	4.21	-0.016	-1.106	1.075
warm-cool	0.44	19	0.665	4.40	0.170	-0.639	0.979
entertaining-boring	-1.31	7	0.232	3.38	-0.855	-2.399	0.689
dominant-recessive	**-2.98**	**20**	**0.007**	**3.19**	-1.040	-1.768	-0.311
cheerful-sad	**3.25**	**11**	**0.008**	**5.58**	1.353	0.436	2.270
bright-dim	1.74	26	0.093	4.67	0.437	-0.078	0.951
harmonious-disharmonious	**2.16**	**25**	**0.041**	**4.77**	0.539	0.024	1.054
frivolous-solemn	-2.21	6	0.069	3.57	-0.659	-1.386	0.069
aggressive-calm	0.76	5	0.481	4.83	0.603	-1.433	2.640
extraordinary-ordinary	-2.01	4	0.115	2.60	-1.630	-3.886	0.626
expressive-unexpressive	0.52	5	0.627	4.67	0.437	-1.731	2.604

Table L.1 (cont'd).

	BROWN :: Test Value = 5.41						
						95% Confidence Interval of the Difference	
Attitude	t	df	Sig. (2-tailed)	Mean	Mean Difference	Lower	Upper
exciting-calming	-0.12	5	0.906	5.33	-0.077	-1.657	1.503
vivid-pale	-0.76	9	0.466	5.10	-0.310	-1.230	0.610
energetic-calm	0.98	16	0.341	5.65	0.237	-0.275	0.749
dynamic-static	0.34	20	0.738	5.52	0.114	-0.586	0.813
active-passive	**3.66**	**8**	**0.006**	**6.22**	0.812	0.300	1.325
conspicuous-inconspicuous	-0.51	17	0.615	5.22	-0.188	-0.961	0.586
soothing-disturbing	**-4.17**	**11**	**0.002**	**3.33**	-2.077	-3.172	-0.982
alive-inanimate	0.24	13	0.814	5.50	0.090	-0.719	0.899
charming-charmless	-1.21	13	0.249	4.93	-0.481	-1.343	0.380
warm-cool	**-3.01**	**19**	**0.007**	**4.40**	-1.010	-1.712	-0.308
entertaining-boring	**8.19**	**7**	**0.000**	**6.75**	1.340	0.953	1.727
dominant-recessive	-0.59	20	0.559	5.19	-0.220	-0.990	0.551
cheerful-sad	0.83	11	0.425	5.67	0.257	-0.425	0.938
bright-dim	**5.62**	**26**	**0.000**	**6.22**	0.812	0.515	1.109
harmonious-disharmonious	**-3.85**	**25**	**0.001**	**4.08**	-1.333	-2.046	-0.620
frivolous-solemn	1.31	6	0.237	5.86	0.447	-0.385	1.279
aggressive-calm	1.14	5	0.305	6.00	0.590	-0.737	1.917
extraordinary-ordinary	1.35	4	0.247	6.20	0.790	-0.829	2.409
expressive-unexpressive	0.42	5	0.694	5.67	0.257	-1.323	1.837

Table L.1 (cont'd).

	BLUE :: Test Value = 4.05						
						95% Confidence Interval of the Difference	
Attitude	t	df	Sig. (2-tailed)	Mean	Mean Difference	Lower	Upper
exciting-calming	0.34	5	0.751	4.33	0.283	-1.884	2.451
vivid-pale	-1.37	9	0.204	3.50	-0.550	-1.458	0.358
energetic-calm	2.99	16	0.009	5.06	1.009	0.294	1.724
dynamic-static	0.91	20	0.375	4.43	0.379	-0.492	1.249
active-passive	-0.68	8	0.516	3.78	-0.272	-1.196	0.652
conspicuous-inconspicuous	**-2.61**	**17**	**0.018**	**3.44**	-0.606	-1.095	-0.116
soothing-disturbing	**-4.32**	**11**	**0.001**	**2.50**	-1.550	-2.340	-0.760
alive-inanimate	-1.06	13	0.311	3.57	-0.479	-1.458	0.501
charming-charmless	-0.10	13	0.919	4.00	-0.050	-1.088	0.988
warm-cool	**5.47**	**19**	**0.000**	**5.65**	1.600	0.987	2.213
entertaining-boring	-0.71	7	0.503	3.50	-0.550	-2.393	1.293
dominant-recessive	-0.36	20	0.723	3.95	-0.098	-0.664	0.469
cheerful-sad	0.38	11	0.710	4.25	0.200	-0.953	1.353
bright-dim	-1.50	26	0.146	3.67	-0.383	-0.910	0.143
harmonious-disharmonious	-1.60	25	0.121	3.50	-0.550	-1.257	0.157
frivolous-solemn	1.22	6	0.269	4.57	0.521	-0.527	1.570
aggressive-calm	**7.67**	**5**	**0.001**	**5.67**	1.617	1.075	2.159
extraordinary-ordinary	0.68	4	0.536	4.60	0.550	-1.706	2.806
expressive-unexpressive	**-3.03**	**5**	**0.029**	**2.83**	-1.217	-2.248	-0.185

Table L.1 (cont'd).

	GREEN :: Test Value = 3.02						
						95% Confidence Interval of the Difference	
Attitude	t	df	Sig. (2-tailed)	Mean	Mean Difference	Lower	Upper
exciting-calming	-0.02	5	0.982	3.00	-0.020	-2.221	2.181
vivid-pale	**-3.80**	**9**	**0.004**	**2.40**	-0.620	-0.989	-0.251
energetic-calm	-1.52	16	0.147	2.53	-0.491	-1.174	0.192
dynamic-static	-0.42	20	0.682	2.86	-0.163	-0.981	0.655
active-passive	-1.53	8	0.165	2.44	-0.576	-1.444	0.293
conspicuous-inconspicuous	-1.64	17	0.119	2.56	-0.464	-1.061	0.132
soothing-disturbing	**2.80**	**11**	**0.017**	**4.50**	1.480	0.315	2.645
alive-inanimate	**-6.92**	**13**	**0.000**	**1.64**	-1.377	-1.807	-0.947
charming-charmless	0.13	13	0.896	3.07	0.051	-0.780	0.882
warm-cool	**4.16**	**19**	**0.001**	**4.60**	1.580	0.785	2.375
entertaining-boring	-0.03	7	0.976	3.00	-0.020	-1.568	1.528
dominant-recessive	0.59	20	0.563	3.19	0.170	-0.434	0.775
cheerful-sad	**-2.65**	**11**	**0.023**	**2.17**	-0.853	-1.562	-0.145
bright-dim	**-3.73**	**26**	**0.001**	**2.26**	-0.761	-1.180	-0.342
harmonious-disharmonious	**6.44**	**25**	**0.000**	**4.65**	1.634	1.111	2.157
frivolous-solemn	**-4.57**	**6**	**0.004**	**1.71**	-1.306	-2.005	-0.607
aggressive-calm	2.36	5	0.065	5.17	2.147	-0.192	4.485
extraordinary-ordinary	-0.02	4	0.982	3.00	-0.020	-2.343	2.303
expressive-unexpressive	-1.21	5	0.279	2.50	-0.520	-1.621	0.581

Table L.2 The results of one sample t-test of eleven basic colours within lightness-purity factor

	BLACK :: Test Value = 4.95						
						95% Confidence Interval of the Difference	
Attitude	t	df	Sig. (2-tailed)	Mean	Mean Difference	Lower	Upper
heavy-light	**a**	**8**	**0.000**	**1.00**	0.000	0.000	0.000
refreshing-suffocating	**3.45**	**6**	**0.014**	**6.43**	1.479	0.430	2.527
innocent-malicious	2.42	4	0.073	6.40	1.450	-0.216	3.116
light-dark	**a**	**23**	**0.000**	**7.00**	0.000	0.000	0.000
pure-impure	0.90	5	0.409	5.83	0.883	-1.637	3.403
luminous-dark	**9.93**	**15**	**0.000**	**6.81**	1.863	1.463	2.262
restful-restless	1.17	5	0.296	5.67	0.717	-0.863	2.297
clean-dirty	0.33	11	0.749	5.17	0.217	-1.238	1.671
positive-negative	**2.38**	**8**	**0.044**	**6.00**	1.050	0.033	2.067
hard-soft	**-38.50**	**9**	**0.000**	**1.10**	-3.850	-4.076	-3.624
clear-complex	-0.57	4	0.600	4.20	-0.750	-4.412	2.912
optimistic-pessimistic	1.52	8	0.167	5.67	0.717	-0.370	1.804
sincere-insincere	0.40	5	0.706	5.17	0.217	-1.178	1.612
cheering-gloomy	**8.30**	**10**	**0.000**	**6.64**	1.686	1.233	2.139
mature-immature	**-58.25**	**14**	**0.000**	**1.07**	-3.883	-4.026	-3.740

a. t cannot be computed because the standard deviation is 0.

	GREY :: Test Value = 4.48						
						95% Confidence Interval of the Difference	
Attitude	t	df	Sig. (2-tailed)	Mean	Mean Difference	Lower	Upper
heavy-light	-0.07	8	0.945	4.44	-0.036	-1.196	1.125
refreshing-suffocating	0.63	6	0.549	4.86	0.377	-1.078	1.832
innocent-malicious	-1.52	4	0.204	4.00	-0.480	-1.358	0.398
light-dark	**-2.35**	**23**	**0.028**	**3.92**	-0.563	-1.060	-0.067
pure-impure	0.47	5	0.657	4.83	0.353	-1.572	2.279
luminous-dark	0.05	15	0.959	4.50	0.020	-0.806	0.846
restful-restless	-1.19	5	0.287	3.83	-0.647	-2.042	0.748
clean-dirty	**3.08**	**11**	**0.010**	**5.58**	1.103	0.315	1.891
positive-negative	1.94	8	0.089	5.33	0.853	-0.164	1.870
hard-soft	0.04	9	0.966	4.50	0.020	-1.006	1.046
clear-complex	**-4.68**	**4**	**0.009**	**3.00**	-1.480	-2.358	-0.602
optimistic-pessimistic	**2.61**	**8**	**0.031**	**5.56**	1.076	0.125	2.026
sincere-insincere	0.88	5	0.419	4.83	0.353	-0.678	1.385
cheering-gloomy	**3.55**	**10**	**0.005**	**5.82**	1.338	0.498	2.178
mature-immature	**-9.18**	**14**	**0.000**	**2.13**	-2.347	-2.895	-1.798

Table L.2 (cont'd).

	WHITE :: Test Value = 2.43						
						95% Confidence Interval of the Difference	
Attitude	t	df	Sig. (2-tailed)	Mean	Mean Difference	Lower	Upper
heavy-light	**25.42**	**8**	**0.000**	**6.67**	4.237	3.852	4.621
refreshing-suffocating	**-3.37**	**6**	**0.015**	**1.43**	-1.001	-1.729	-0.274
innocent-malicious	**a**	**4**	**0.000**	**1.00**	0.000	0.000	0.000
light-dark	**-33.32**	**23**	**0.000**	**1.04**	-1.388	-1.475	-1.302
pure-impure	**-5.20**	**5**	**0.003**	**1.33**	-1.097	-1.639	-0.555
luminous-dark	**-6.63**	**15**	**0.000**	**1.19**	-1.243	-1.642	-0.843
restful-restless	-0.72	5	0.506	1.83	-0.597	-2.739	1.545
clean-dirty	**a**	**11**	**0.000**	**1.00**	0.000	0.000	0.000
positive-negative	-0.21	8	0.843	2.33	-0.097	-1.184	0.990
hard-soft	**6.09**	**9**	**0.000**	**5.60**	3.170	1.992	4.348
clear-complex	**-6.15**	**4**	**0.004**	**1.20**	-1.230	-1.785	-0.675
optimistic-pessimistic	-0.26	8	0.802	2.33	-0.097	-0.956	0.763
sincere-insincere	0.54	5	0.613	2.83	0.403	-1.522	2.329
cheering-gloomy	-0.39	10	0.707	2.27	-0.157	-1.063	0.749
mature-immature	**3.22**	**14**	**0.006**	**4.00**	1.570	0.523	2.617

a. t cannot be computed because the standard deviation is 0.

	YELLOW :: Test Value = 3.10						
						95% Confidence Interval of the Difference	
Attitude	t	df	Sig. (2-tailed)	Mean	Mean Difference	Lower	Upper
heavy-light	**5.72**	**8**	**0.000**	**5.11**	2.011	1.201	2.821
refreshing-suffocating	-2.25	6	0.065	2.00	-1.100	-2.294	0.094
innocent-malicious	**-2.86**	**4**	**0.046**	**2.40**	-0.700	-1.380	-0.020
light-dark	**-5.90**	**23**	**0.000**	**2.33**	-0.767	-1.036	-0.498
pure-impure	0.84	5	0.439	3.83	0.733	-1.509	2.976
luminous-dark	-1.90	15	0.077	2.50	-0.600	-1.274	0.074
restful-restless	0.71	5	0.512	3.67	0.567	-1.497	2.630
clean-dirty	-0.96	11	0.356	2.67	-0.433	-1.423	0.556
positive-negative	-1.75	8	0.118	2.11	-0.989	-2.289	0.311
hard-soft	1.41	9	0.192	3.90	0.800	-0.482	2.082
clear-complex	-1.37	4	0.242	2.40	-0.700	-2.116	0.716
optimistic-pessimistic	**-3.92**	**8**	**0.004**	**1.89**	-1.211	-1.924	-0.498
sincere-insincere	1.74	5	0.142	4.00	0.900	-0.427	2.227
cheering-gloomy	**-6.65**	**10**	**0.000**	**1.45**	-1.645	-2.196	-1.094
mature-immature	**7.92**	**14**	**0.000**	**5.80**	2.700	1.969	3.431

Table L.2 (cont'd).

	ORANGE :: Test Value = 3.55						
						95% Confidence Interval of the Difference	
Attitude	t	df	Sig. (2-tailed)	Mean	Mean Difference	Lower	Upper
heavy-light	1.44	8	0.187	4.11	0.561	-0.336	1.458
refreshing-suffocating	-0.56	6	0.597	3.29	-0.264	-1.424	0.895
innocent-malicious	**-3.61**	**4**	**0.023**	**2.20**	-1.350	-2.389	-0.311
light-dark	1.03	23	0.312	3.71	0.158	-0.159	0.475
pure-impure	1.69	5	0.152	4.50	0.950	-0.497	2.397
luminous-dark	-0.88	15	0.392	3.31	-0.238	-0.812	0.337
restful-restless	0.62	5	0.565	4.00	0.450	-1.427	2.327
clean-dirty	-3.20	11	0.008	2.75	-0.800	-1.350	-0.250
positive-negative	**-2.76**	**8**	**0.025**	**2.33**	-1.217	-2.234	-0.200
hard-soft	0.13	9	0.896	3.60	0.050	-0.790	0.890
clear-complex	0.67	4	0.541	3.80	0.250	-0.789	1.289
optimistic-pessimistic	-1.41	8	0.196	2.78	-0.772	-2.034	0.490
sincere-insincere	0.88	5	0.421	4.17	0.617	-1.191	2.424
cheering-gloomy	**-10.09**	**10**	**0.000**	**1.91**	-1.641	-2.003	-1.279
mature-immature	**10.91**	**14**	**0.000**	**6.20**	2.650	2.129	3.171

	RED :: Test Value = 4.02						
						95% Confidence Interval of the Difference	
Attitude	t	df	Sig. (2-tailed)	Mean	Mean Difference	Lower	Upper
heavy-light	**-3.82**	**8**	**0.005**	**2.44**	-1.576	-2.526	-0.625
refreshing-suffocating	2.43	6	0.051	4.71	0.694	-0.005	1.393
innocent-malicious	-0.04	4	0.966	4.00	-0.020	-1.262	1.222
light-dark	**4.42**	**23**	**0.000**	**4.88**	0.855	0.455	1.255
pure-impure	1.84	5	0.126	5.33	1.313	-0.524	3.151
luminous-dark	0.12	15	0.907	4.06	0.043	-0.723	0.808
restful-restless	**4.94**	**5**	**0.004**	**5.67**	1.647	0.790	2.504
clean-dirty	-0.05	11	0.962	4.00	-0.020	-0.919	0.879
positive-negative	-0.05	8	0.965	4.00	-0.020	-1.037	0.997
hard-soft	**-5.73**	**9**	**0.000**	**2.30**	-1.720	-2.399	-1.041
clear-complex	0.91	4	0.416	4.80	0.780	-1.608	3.168
optimistic-pessimistic	**-2.38**	**8**	**0.045**	**3.44**	-0.576	-1.134	-0.017
sincere-insincere	-0.22	5	0.832	3.83	-0.187	-2.329	1.955
cheering-gloomy	-2.08	10	0.064	3.27	-0.747	-1.547	0.053
mature-immature	-1.07	14	0.304	3.53	-0.487	-1.465	0.492

Table L.2 (cont'd).

	PINK :: Test Value = 3.48						
						95% Confidence Interval of the Difference	
Attitude	t	df	Sig. (2-tailed)	Mean	Mean Difference	Lower	Upper
heavy-light	**13.14**	**8**	**0.000**	**6.11**	2.631	2.169	3.093
refreshing-suffocating	-1.36	6	0.224	2.86	-0.623	-1.747	0.501
innocent-malicious	**-11.40**	**4**	**0.000**	**1.20**	-2.280	-2.835	-1.725
light-dark	**-6.88**	**23**	**0.000**	**2.33**	-1.147	-1.491	-0.802
pure-impure	-0.18	5	0.862	3.33	-0.147	-2.210	1.917
luminous-dark	**-3.39**	**15**	**0.004**	**2.50**	-0.980	-1.595	-0.365
restful-restless	**-2.72**	**5**	**0.042**	**2.33**	-1.147	-2.231	-0.063
clean-dirty	-1.99	11	0.073	2.58	-0.897	-1.891	0.097
positive-negative	**-2.53**	**8**	**0.035**	**2.78**	-0.702	-1.343	-0.062
hard-soft	**18.12**	**9**	**0.000**	**6.50**	3.020	2.643	3.397
clear-complex	-1.73	4	0.159	2.60	-0.880	-2.296	0.536
optimistic-pessimistic	**-2.45**	**8**	**0.040**	**2.56**	-0.924	-1.793	-0.056
sincere-insincere	1.28	5	0.257	4.33	0.853	-0.860	2.567
cheering-gloomy	-0.62	10	0.547	3.27	-0.207	-0.949	0.534
mature-immature	**10.91**	**14**	**0.000**	**6.47**	2.987	2.400	3.574

	PURPLE :: Test Value = 4.71						
						95% Confidence Interval of the Difference	
Attitude	t	df	Sig. (2-tailed)	Mean	Mean Difference	Lower	Upper
heavy-light	-5.48	8	0.001	2.67	-2.043	-2.903	-1.184
refreshing-suffocating	2.34	6	0.058	5.57	0.861	-0.041	1.764
innocent-malicious	-0.87	4	0.431	4.20	-0.510	-2.129	1.109
light-dark	3.95	23	0.001	5.38	0.665	0.317	1.013
pure-impure	1.87	5	0.120	5.33	0.623	-0.234	1.480
luminous-dark	1.19	15	0.251	5.06	0.353	-0.277	0.982
restful-restless	-0.27	5	0.794	4.50	-0.210	-2.173	1.753
clean-dirty	0.83	11	0.423	5.00	0.290	-0.476	1.056
positive-negative	0.71	8	0.497	5.11	0.401	-0.899	1.701
hard-soft	-1.87	9	0.094	3.90	-0.810	-1.790	0.170
clear-complex	4.08	4	0.015	6.00	1.290	0.412	2.168
optimistic-pessimistic	-1.32	8	0.224	4.11	-0.599	-1.648	0.450
sincere-insincere	-0.34	5	0.748	4.50	-0.210	-1.802	1.382
cheering-gloomy	1.18	10	0.266	5.18	0.472	-0.420	1.364
mature-immature	-2.73	14	0.016	3.73	-0.977	-1.745	-0.209

Table L.2 (cont'd).

	BROWN :: Test Value = 4.83						
						95% Confidence Interval of the Difference	
Attitude	t	df	Sig. (2-tailed)	Mean	Mean Difference	Lower	Upper
heavy-light	**-13.42**	**8**	**0.000**	**1.67**	-3.163	-3.707	-2.620
refreshing-suffocating	**3.10**	**6**	**0.021**	**5.71**	0.884	0.185	1.583
innocent-malicious	-0.03	4	0.974	4.80	-0.030	-2.418	2.358
light-dark	**9.54**	**23**	**0.000**	**5.88**	1.045	0.818	1.272
pure-impure	0.60	5	0.577	5.33	0.503	-1.664	2.671
luminous-dark	**3.27**	**15**	**0.005**	**5.75**	0.920	0.320	1.520
restful-restless	-0.97	5	0.377	4.00	-0.830	-3.031	1.371
clean-dirty	**2.48**	**11**	**0.031**	**5.83**	1.003	0.112	1.895
positive-negative	2.07	8	0.073	5.89	1.059	-0.122	2.240
hard-soft	**-3.43**	**9**	**0.008**	**3.10**	-1.730	-2.871	-0.589
clear-complex	**3.66**	**4**	**0.022**	**6.20**	1.370	0.331	2.409
optimistic-pessimistic	0.58	8	0.578	5.11	0.281	-0.836	1.398
sincere-insincere	-0.29	5	0.781	4.67	-0.163	-1.597	1.270
cheering-gloomy	**3.88**	**10**	**0.003**	**6.00**	1.170	0.498	1.842
mature-immature	**-10.04**	**14**	**0.000**	**2.20**	-2.630	-3.192	-2.068

	BLUE :: Test Value = 3.51						
						95% Confidence Interval of the Difference	
Attitude	t	df	Sig. (2-tailed)	Mean	Mean Difference	Lower	Upper
heavy-light	**2.48**	**8**	**0.038**	**4.44**	0.934	0.066	1.803
refreshing-suffocating	-0.52	6	0.621	3.14	-0.367	-2.091	1.357
innocent-malicious	-1.90	4	0.131	2.80	-0.710	-1.749	0.329
light-dark	**5.63**	**23**	**0.000**	**4.67**	1.157	0.731	1.582
pure-impure	-1.79	5	0.133	2.50	-1.010	-2.457	0.437
luminous-dark	1.71	15	0.107	4.06	0.553	-0.135	1.240
restful-restless	-1.91	5	0.114	2.33	-1.177	-2.757	0.403
clean-dirty	-0.34	11	0.744	3.33	-0.177	-1.337	0.983
positive-negative	-0.92	8	0.385	2.89	-0.621	-2.180	0.937
hard-soft	0.45	9	0.664	3.70	0.190	-0.767	1.147
clear-complex	1.45	4	0.221	3.80	0.290	-0.265	0.845
optimistic-pessimistic	-0.89	8	0.400	3.22	-0.288	-1.035	0.459
sincere-insincere	-0.63	5	0.555	3.17	-0.343	-1.738	1.052
cheering-gloomy	0.96	10	0.358	3.91	0.399	-0.525	1.323
mature-immature	**3.05**	**14**	**0.009**	**4.33**	0.823	0.244	1.403

Table L.2 (cont'd).

	GREEN :: Test Value = 3.24						
						95% Confidence Interval of the Difference	
Attitude	t	df	Sig. (2-tailed)	Mean	Mean Difference	Lower	Upper
heavy-light	**4.28**	**8**	**0.003**	**4.67**	1.427	0.658	2.195
refreshing-suffocating	**-3.31**	**6**	**0.016**	**2.57**	-0.669	-1.163	-0.174
innocent-malicious	-1.18	4	0.305	2.80	-0.440	-1.479	0.599
light-dark	-0.66	23	0.514	3.13	-0.115	-0.474	0.244
pure-impure	**-4.30**	**5**	**0.008**	**2.33**	-0.907	-1.449	-0.365
luminous-dark	0.65	15	0.523	3.44	0.198	-0.447	0.842
restful-restless	-0.85	5	0.433	2.83	-0.407	-1.634	0.820
clean-dirty	0.57	11	0.577	3.50	0.260	-0.735	1.255
positive-negative	**-2.79**	**8**	**0.023**	**2.22**	-1.018	-1.858	-0.178
hard-soft	1.78	9	0.108	4.10	0.860	-0.230	1.950
clear-complex	0.65	4	0.549	3.40	0.160	-0.520	0.840
optimistic-pessimistic	**-3.65**	**8**	**0.006**	**2.11**	-1.129	-1.842	-0.416
sincere-insincere	-0.24	5	0.821	3.17	-0.073	-0.863	0.717
cheering-gloomy	**-3.14**	**10**	**0.010**	**2.36**	-0.876	-1.497	-0.255
mature-immature	**6.51**	**14**	**0.000**	**5.60**	2.360	1.582	3.138

Table L.3 The results of one sample t-test of eleven basic colours within evaluation factor

	BLACK :: Test Value = 3.23						
						95% Confidence Interval of the Difference	
Attitude	t	df	Sig. (2-tailed)	Mean	Mean Difference	Lower	Upper
beautiful-ugly	-0.03	4	0.979	3.20	-0.030	-2.994	2.934
modern-traditional	-0.19	6	0.856	3.14	-0.087	-1.211	1.037
attractive-repulsive	0.45	13	0.660	3.43	0.199	-0.755	1.152

	GREY :: Test Value = 2.43						
						95% Confidence Interval of the Difference	
Attitude	t	df	Sig. (2-tailed)	Mean	Mean Difference	Lower	Upper
beautiful-ugly	1.71	4	0.162	3.80	1.370	-0.851	3.591
modern-traditional	0.60	6	0.570	2.71	0.284	-0.875	1.444
attractive-repulsive	**5.62**	**13**	**0.000**	**5.00**	**2.570**	1.583	3.557

	WHITE :: Test Value = 3.30						
						95% Confidence Interval of the Difference	
Attitude	t	df	Sig. (2-tailed)	Mean	Mean Difference	Lower	Upper
beautiful-ugly	-0.17	4	0.872	3.20	-0.100	-1.719	1.519
modern-traditional	0.44	6	0.673	3.57	0.271	-1.225	1.768
attractive-repulsive	-0.42	13	0.683	3.14	-0.157	-0.969	0.655

	YELLOW :: Test Value = 4.10						
						95% Confidence Interval of the Difference	
Attitude	t	df	Sig. (2-tailed)	Mean	Mean Difference	Lower	Upper
beautiful-ugly	-0.80	4	0.468	3.80	-0.300	-1.339	0.739
modern-traditional	0.66	6	0.536	4.57	0.471	-1.288	2.231
attractive-repulsive	-0.40	13	0.693	3.93	-0.171	-1.090	0.747

Table L.3 (cont'd).

	ORANGE :: Test Value = 3.30						
						95% Confidence Interval of the Difference	
Attitude	t	df	Sig. (2-tailed)	Mean	Mean Difference	Lower	Upper
beautiful-ugly	0.17	4	0.876	3.40	0.100	-1.566	1.766
modern-traditional	-0.02	6	0.983	3.29	-0.014	-1.591	1.562
attractive-repulsive	-0.18	13	0.858	3.21	-0.086	-1.103	0.932

	RED :: Test Value = 3.13						
						95% Confidence Interval of the Difference	
Attitude	t	df	Sig. (2-tailed)	Mean	Mean Difference	Lower	Upper
beautiful-ugly	-0.57	4	0.602	2.80	-0.330	-1.949	1.289
modern-traditional	2.10	6	0.080	4.57	1.441	-0.235	3.118
attractive-repulsive	**-2.88**	**13**	**0.013**	**2.00**	-1.130	-1.977	-0.283

	PINK :: Test Value = 5.00						
						95% Confidence Interval of the Difference	
Attitude	t	df	Sig. (2-tailed)	Mean	Mean Difference	Lower	Upper
beautiful-ugly	0.39	4	0.717	5.40	0.400	-2.459	3.259
modern-traditional	0.00	6	1.000	5.00	0.000	-1.771	1.771
attractive-repulsive	-0.89	13	0.389	4.64	-0.357	-1.223	0.508

	PURPLE :: Test Value = 3.73						
						95% Confidence Interval of the Difference	
Attitude	t	df	Sig. (2-tailed)	Mean	Mean Difference	Lower	Upper
beautiful-ugly	0.10	4	0.929	3.80	0.070	-1.970	2.110
modern-traditional	0.20	6	0.848	3.86	0.127	-1.423	1.677
attractive-repulsive	-0.61	13	0.550	3.50	-0.230	-1.039	0.579

Table L.3 (cont'd).

	BROWN :: Test Value = 6.07						
						95% Confidence Interval of the Difference	
Attitude	t	df	Sig. (2-tailed)	Mean	Mean Difference	Lower	Upper
beautiful-ugly	1.35	4	0.249	6.40	0.330	-0.350	1.010
modern-traditional	-0.12	6	0.907	6.00	-0.070	-1.483	1.343
attractive-repulsive	-0.72	13	0.484	5.79	-0.284	-1.137	0.568

	BLUE :: Test Value = 3.93						
						95% Confidence Interval of the Difference	
Attitude	t	df	Sig. (2-tailed)	Mean	Mean Difference	Lower	Upper
beautiful-ugly	-1.04	4	0.357	3.40	-0.530	-1.946	0.886
modern-traditional	0.13	6	0.900	4.00	0.070	-1.238	1.378
attractive-repulsive	1.53	13	0.151	4.43	0.499	-0.207	1.204

	GREEN :: Test Value = 3.13						
						95% Confidence Interval of the Difference	
Attitude	t	df	Sig. (2-tailed)	Mean	Mean Difference	Lower	Upper
beautiful-ugly	-0.41	4	0.702	3.00	-0.130	-1.008	0.748
modern-traditional	-0.24	6	0.816	3.00	-0.130	-1.438	1.178
attractive-repulsive	0.77	13	0.456	3.43	0.299	-0.540	1.137

Table L.4 The results of one sample t-test of eleven basic colours within familiarity factor

	BLACK :: Test Value = 2.78						
						95% Confidence Interval of the Difference	
Attitude	t	df	Sig. (2-tailed)	Mean	Mean Difference	Lower	Upper
familiar-unfamiliar	0.59	7	0.574	3.25	0.470	-1.413	2.353
natural-artificial	**4.23**	**31**	**0.000**	**4.50**	1.720	0.891	2.549
common-rare	-1.15	6	0.293	2.14	-0.637	-1.991	0.717
strong-weak	**-9.68**	**5**	**0.000**	**1.17**	-1.613	-2.042	-1.185

	GREY :: Test Value = 3.95						
						95% Confidence Interval of the Difference	
Attitude	t	df	Sig. (2-tailed)	Mean	Mean Difference	Lower	Upper
familiar-unfamiliar	-1.50	7	0.177	3.13	-0.825	-2.123	0.473
natural-artificial	**3.54**	**31**	**0.001**	**5.13**	1.175	0.497	1.853
common-rare	-2.22	6	0.068	2.43	-1.521	-3.198	0.155
strong-weak	2.55	5	0.051	5.17	1.217	-0.010	2.444

	WHITE :: Test Value = 3.05						
						95% Confidence Interval of the Difference	
Attitude	t	df	Sig. (2-tailed)	Mean	Mean Difference	Lower	Upper
familiar-unfamiliar	-1.59	7	0.155	2.13	-0.925	-2.298	0.448
natural-artificial	0.83	31	0.414	3.41	0.356	-0.521	1.234
common-rare	-0.23	6	0.829	2.86	-0.193	-2.290	1.904
strong-weak	0.77	5	0.475	3.83	0.783	-1.823	3.389

	YELLOW :: Test Value = 3.50						
						95% Confidence Interval of the Difference	
Attitude	t	df	Sig. (2-tailed)	Mean	Mean Difference	Lower	Upper
familiar-unfamiliar	0.71	7	0.502	4.00	0.500	-1.172	2.172
natural-artificial	**-2.53**	**31**	**0.017**	**2.72**	-0.781	-1.411	-0.152
common-rare	0.75	6	0.482	4.14	0.643	-1.454	2.740
strong-weak	-1.08	5	0.328	3.17	-0.333	-1.123	0.457

Table L.4 (cont'd).

ORANGE :: Test Value = 4.28

Attitude	t	df	Sig. (2-tailed)	Mean	Mean Difference	95% Confidence Interval of the Difference Lower	Upper
familiar-unfamiliar	-0.49	7	0.637	4.00	-0.280	-1.621	1.061
natural-artificial	-1.48	31	0.149	3.81	-0.468	-1.111	0.176
common-rare	2.39	6	0.054	5.29	1.006	-0.023	2.035
strong-weak	-0.44	5	0.676	4.00	-0.280	-1.906	1.346

RED :: Test Value = 3.23

Attitude	t	df	Sig. (2-tailed)	Mean	Mean Difference	95% Confidence Interval of the Difference Lower	Upper
familiar-unfamiliar	0.40	7	0.704	3.50	0.270	-1.341	1.881
natural-artificial	0.53	31	0.598	3.38	0.145	-0.410	0.700
common-rare	1.48	6	0.190	4.29	1.056	-0.692	2.804
strong-weak	**-4.69**	**5**	**0.005**	**1.67**	-1.563	-2.420	-0.706

PINK :: Test Value = 5.13

Attitude	t	df	Sig. (2-tailed)	Mean	Mean Difference	95% Confidence Interval of the Difference Lower	Upper
familiar-unfamiliar	0.46	7	0.659	5.38	0.245	-1.014	1.504
natural-artificial	-1.18	31	0.246	4.84	-0.286	-0.780	0.208
common-rare	0.03	6	0.981	5.14	0.013	-1.231	1.257
strong-weak	0.06	5	0.957	5.17	0.037	-1.645	1.718

PURPLE :: Test Value = 5.05

Attitude	t	df	Sig. (2-tailed)	Mean	Mean Difference	95% Confidence Interval of the Difference Lower	Upper
familiar-unfamiliar	0.77	7	0.464	5.38	0.325	-0.668	1.318
natural-artificial	0.83	31	0.415	5.22	0.169	-0.248	0.586
common-rare	1.87	6	0.110	5.43	0.379	-0.116	0.873
strong-weak	-1.11	5	0.316	4.17	-0.883	-2.920	1.153

Table L.4 (cont'd).

	BROWN :: Test Value = 2.33						
						95% Confidence Interval of the Difference	
Attitude	t	df	Sig. (2-tailed)	Mean	Mean Difference	Lower	Upper
familiar-unfamiliar	**-2.68**	**7**	**0.032**	**1.63**	-0.705	-1.327	-0.083
natural-artificial	0.04	31	0.966	2.34	0.014	-0.631	0.659
common-rare	-1.81	6	0.120	1.86	-0.473	-1.111	0.165
strong-weak	1.74	5	0.142	3.50	1.170	-0.554	2.894

	BLUE :: Test Value = 2.65						
						95% Confidence Interval of the Difference	
Attitude	t	df	Sig. (2-tailed)	Mean	Mean Difference	Lower	Upper
familiar-unfamiliar	-1.09	7	0.311	2.25	-0.400	-1.265	0.465
natural-artificial	-0.57	31	0.572	2.47	-0.181	-0.829	0.466
common-rare	-0.70	6	0.511	2.29	-0.364	-1.641	0.912
strong-weak	1.18	5	0.290	3.50	0.850	-0.998	2.698

	GREEN :: Test Value = 3.30						
						95% Confidence Interval of the Difference	
Attitude	t	df	Sig. (2-tailed)	Mean	Mean Difference	Lower	Upper
familiar-unfamiliar	1.51	7	0.174	4.00	0.700	-0.395	1.795
natural-artificial	**-2.54**	**31**	**0.016**	**2.47**	-0.831	-1.498	-0.165
common-rare	0.45	6	0.668	3.71	0.414	-1.833	2.662
strong-weak	-0.82	5	0.449	3.00	-0.300	-1.239	0.639

APPENDIX M

FIFTY-FIVE PROBABILITIES OF ELEVEN BASIC COLOURS IN DYADS

Table M.1 Fifty-five probabilities of eleven basic colours in dyads

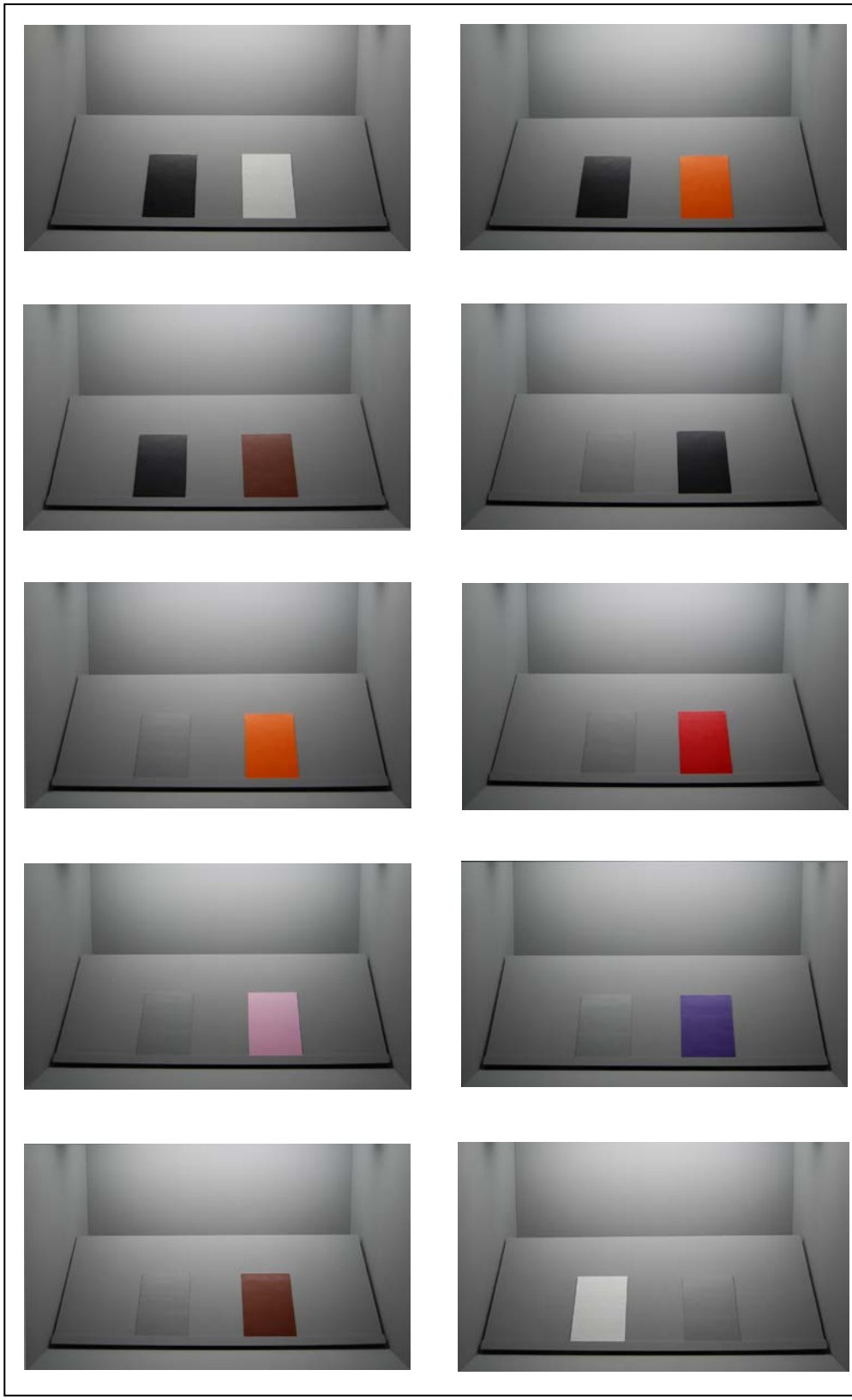


Table M.1 (cont'd).

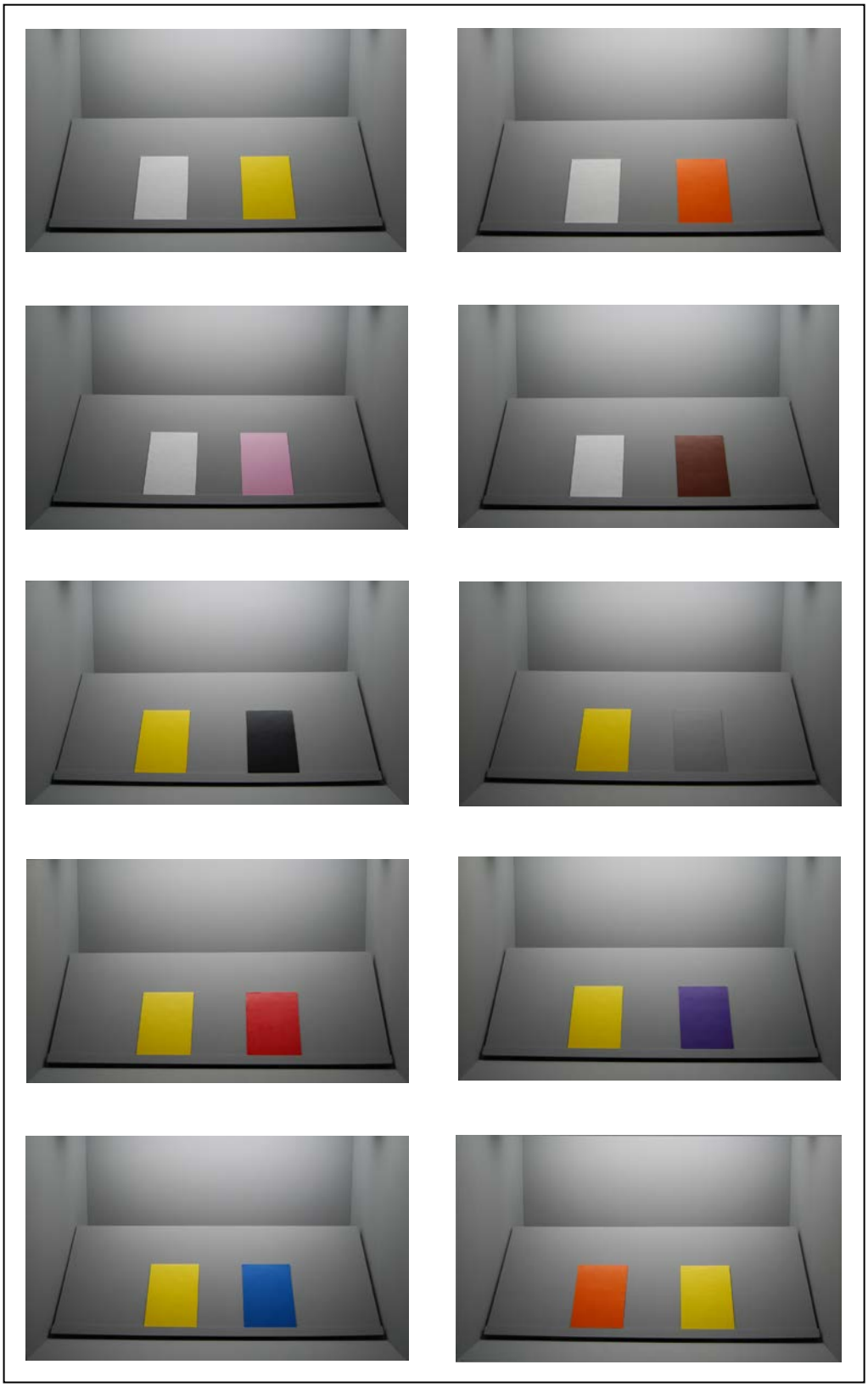


Table M.1 (cont'd).

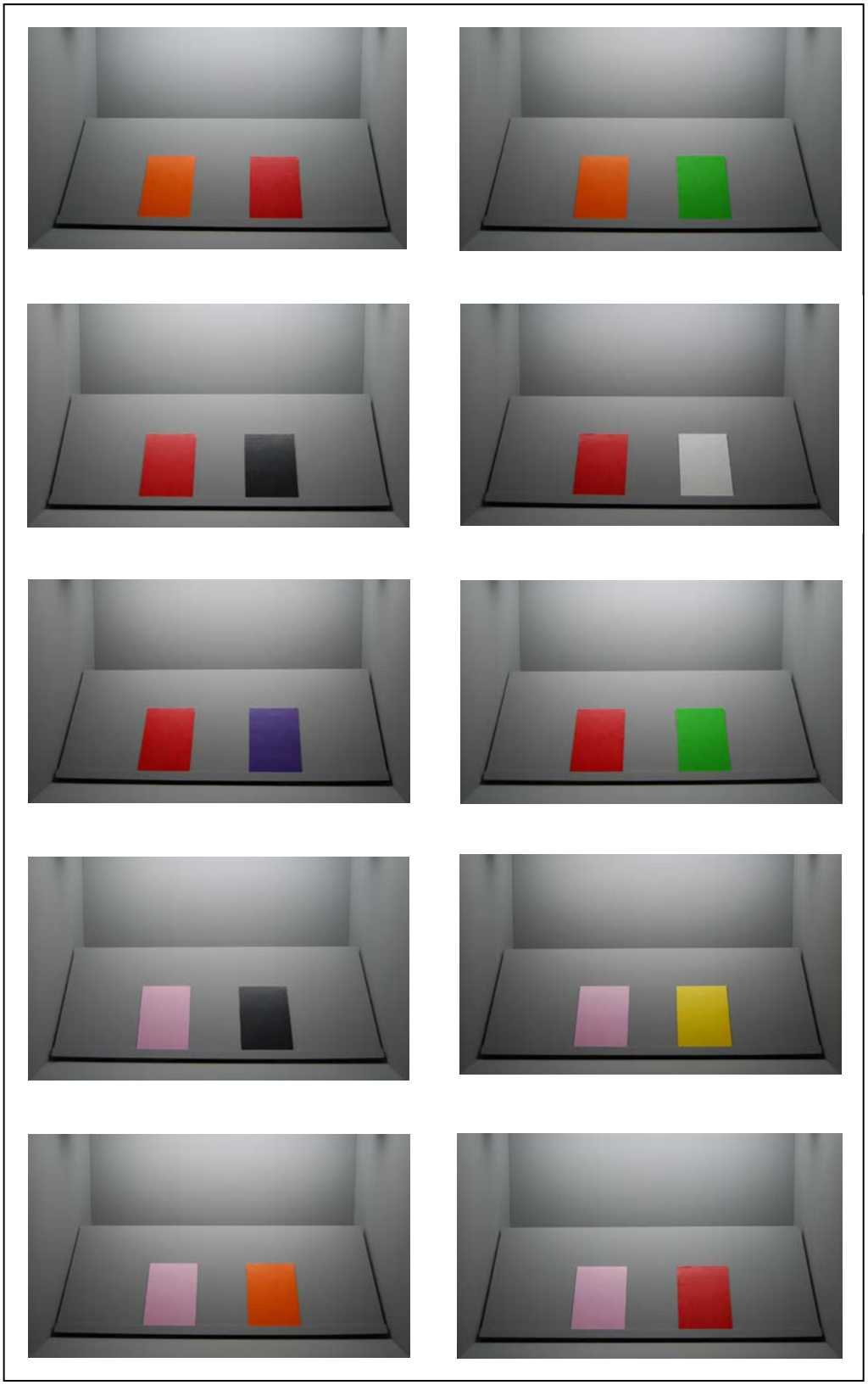


Table M.1 (cont'd).

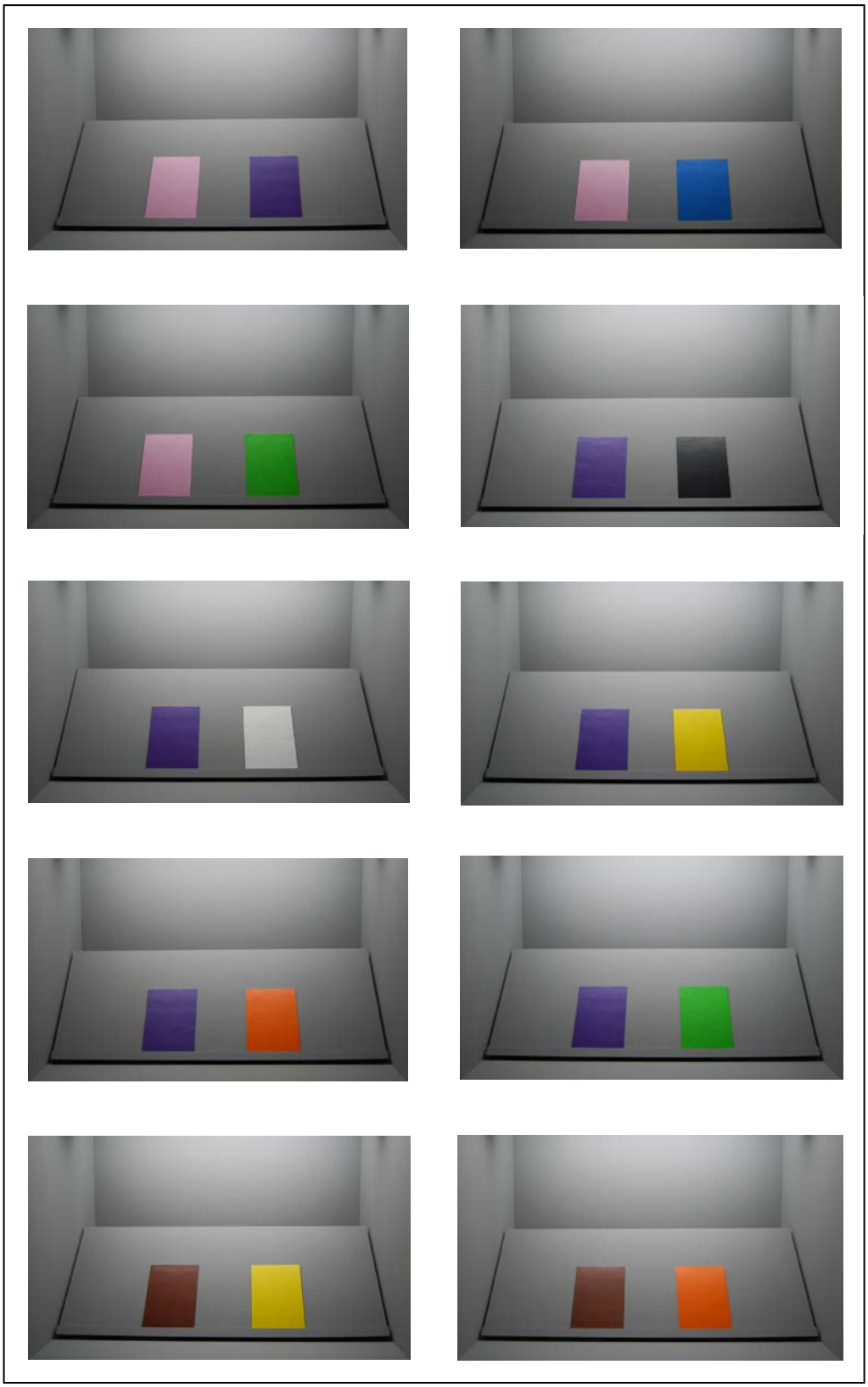


Table M.1 (cont'd).

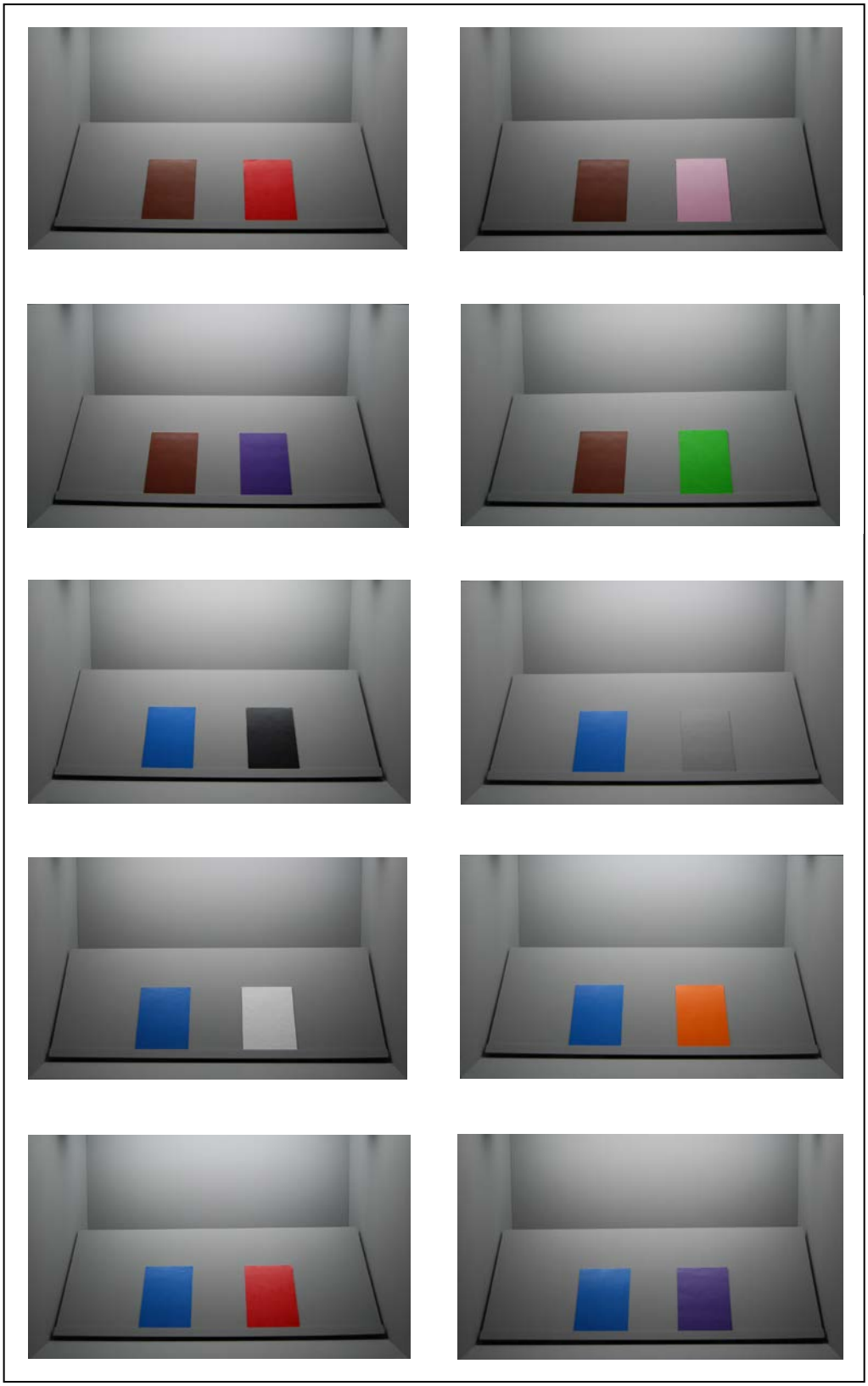
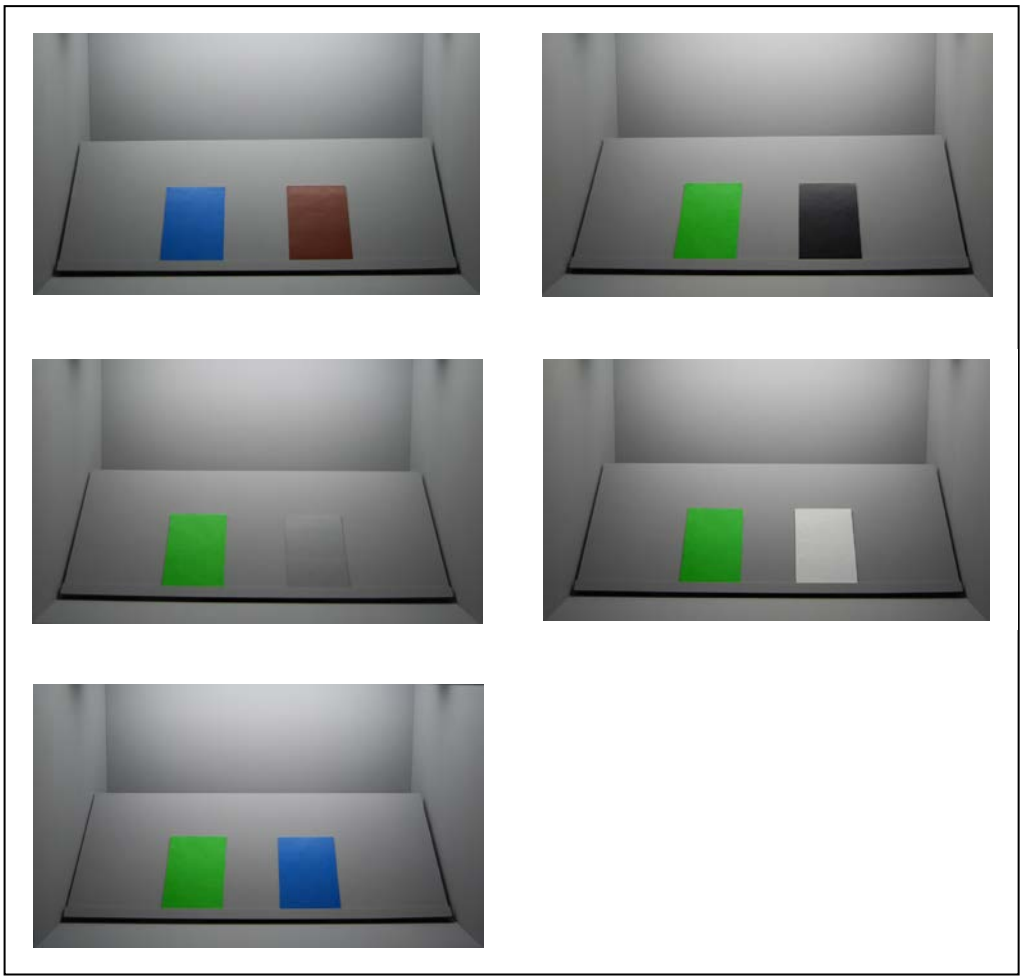


Table M.1 (cont'd).



CURRICULUM VITAE

PERSONAL INFORMATION

Surname, Name:	Akbay Yenigül, Saadet
Nationality:	Turkish (TC)
Date and Place of Birth:	February 2, 1978, Ankara
Marital Status:	Married
Phone:	+90 312 284 45 00
Email:	saadet.akbay@gmail.com

EDUCATION

Degree	**Institution**	**Year of Graduation**
MFA	Bilkent University, Interior Architecture and Environmental Design	2003
BFA	Bilkent University, Interior Architecture and Environmental Design	2001
High School	TED Ankara College	1996

WORK EXPERIENCE

Year	**Place**	**Enrollment**
2004-Present	Çankaya University, Interior Architecture	Research Assistant
2004	E-C İnşaat Mob. Bil. San. Tic. Ltd. Şti.	Interior Architect
2004	Korçelik-Euroform Büro Mobilya Sistemleri San. Ve Tic. A.Ş.	Interior Architect
2003	MN İnşaat Dış Tic. Ltd. Şti.	Interior Architect
2000 July	YMS Tasarım ve Pazarlama Şti.	Internship
1999 July	ANSERA Trade Center	Internship

FOREIGN LANGUAGES

Advanced English, Intermediate Italian

PUBLICATIONS

1. Ertez Ural, S., Yilmazer, S., & Akbay, S. (2011). A comparative study on colour and light visualization techniques: Architectural models versus full-scale setups. In *Proceedings of the Midterm Meeting of the International Colour Association (AIC), AIC 2011 Interaction of Colour & Light in the Arts and Sciences, June 7-10*, Zurich, Switzerland, 177-180.

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