

MASTER THESIS

The influence of colour and scent on people's mood and cognitive performance in meeting rooms

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Abstract

This research project examined to what extent atmospherics affect people's mood and cognitive performance in meeting rooms. More specifically, the research question was: *To what extent do colour and scent, also in combined application based on arousal congruence, affect people's mood and cognitive performance in meeting rooms?* Thereby it was checked if arousal worked as a mediator and sensation seeking, gender, age and education as moderators. Cool colours and relaxing scents, compared to warm colours and stimulating scents, were expected to lead to improved mood and enhanced cognitive performance because of the fact that low-arousing features have less distracting properties. Based on the processing fluency theory, it was predicted that an environment elicits a positive response when the environmental features were congruent in terms of arousal. In general, arousal congruence leads to easier processing which in turns leads to positive evaluations and more favorable attitudes.

In total, 122 participants completed a cognitive performance test and a questionnaire in a meeting room in one of the four colour-scent conditions: blue-sandalwood, red-peppermint (congruence) and blue-peppermint and red-sandalwood (incongruence). These environmental features were selected based on a stimulating/relaxing rate.

Use of cool colours and relaxing scents, compared to warm colours and stimulating scents, led to less feelings of arousal in meeting rooms. The effects of combined application of colour and scent based on arousal congruence on pleasure were moderated by gender and thrill and adventure seeking, a subscale of sensation seeking. Use of cool colours also led to improved performance on a demanding cognitive task. However, on a more detail-oriented cognitive task, performance of individuals improved in a warm coloured meeting room. Thereby, gender and education moderated the effects of scent on a detail-oriented cognitive task. Combined application of colour and scent resulted in enhanced performance on a high demanding cognitive task in congruent conditions compared to incongruent conditions.

In conclusion, in case of making use of colour and scent separately, it is necessary to provide insight in the activities that will take place in the meeting room. When making use of both environmental features in a meeting room, it is recommended to combine colour and scent based on arousal congruence.

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After more than two and a half years there comes an end to my study Communication Studies at the University of Twente. I can look back on an interesting period of time with both study-related and non-study-related activities in Enschede. Early in the master Marketing Communication, I became interested in the effects of environmental features on people in several fields of application, for example in service environments like railway stations. During various courses in the master and work as a student assistant, my interest in this subject increased and I decided to delve further into the subject. This resulted in underlying report about the (combined) application of colour and scent on people's mood and cognitive performance in meeting rooms.

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Enjoy reading!

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1. Introduction

This chapter describes the subject, background and purpose of the research project. Next, an explanation of the practical and scientific relevance follows as well as an overview of the report.

1.1 Subject, background and purpose

According to Young and Cheang (2009), manufacturing teams in factories, students in classrooms and employees in offices are more productive when functioning in attractive environments that are interesting rather than dull. Though, the aforementioned authors argued that organizations typically include grey coloured walls, grey furniture, harsh lighting and industrial flooring in meeting rooms. Meeting rooms are often designed for cost-effective, efficiency or practical reasons, however these designs also make spaces sterile, unpleasant and uninviting (Young & Cheang, 2009). This research project examined the application of atmospherics to improve people's mood and cognitive performance in meeting rooms. Atmospherics are tangible and intangible environmental features that may affect people's emotions and behaviour.

Productivity is seen as a key concept in companies and institutions. These organizations lay focus on making environments more comfortable and inviting to make sure that people can function at their optimum. In meeting rooms, much consultation takes place that requires cognitive performance of the participating parties. From earlier research, it is known that environmental features in terms of architectural, interior design and ambient features affect human behaviour in general (Borchardt, 2008; Danielsson & Bodin, 2008). Examples of environmental features include the temperature of a room, the texture and colour of the walls and flooring (Young & Cheang, 2009). All these physical settings may cause cognitive and emotional reactions. It is therefore interesting to know to what extent environmental features affect mood and cognitive performance. Mood and cognitive performance are related to productivity, for example productivity of manufacturing teams in factories or students in classrooms (Kwallek, Soon & Lewis, 2007).

This research project examined to what extent colour and scent do affect people's mood and cognitive performance in meeting rooms. The reason why colour and scent are chosen from all environmental features is that interior design features (i.e. colour) as well as ambient features (i.e. scent) provide relatively uncomplicated and inexpensive ways to change the atmosphere of an

environment (Dijkstra, 2009). Organizations are more willing to implement changes in interior design and ambient features compared to architectural features due to the fact that these features are far less expensive and easier to apply.

It is assumed that the environment elicits a positive affective response when environmental features are congruent in terms of arousal (Mattila & Wirtz, 2001). This positive affective response may lead to improvement of people's mood and cognitive performance, while negative affective reactions may lead to impairment of these aspects.

1.2 Practical and scientific relevance

The results of this research project may be of great importance for a variety of organizations. It could help managers who intend to make use of environmental features (i.e. colour and scent) to stimulate employees in office buildings or production areas. (Combined) application of colour and scent may lead to improved mood and cognitive performance of individuals. Improvement of these factors may result in higher productivity of employees, which gives the organization the opportunity to flourish. Besides the aforementioned field of application, this research project may also provide guidance to the (combined) application of both environmental features in educational institutions, healthcare settings and the hotel and catering industry.

From a scientific viewpoint, many studies have investigated the effects of environmental features on people's behaviour in public spaces. For example, research of Van Hagen (2011) focussed on the influence of colour in a public railway station. He found that warm colours are successful when it comes to drawing people in but less so when it comes to making them feel at ease. According to Van Hagen (2011), it is better to use cool colours in situations where people experience mental pressure. This prevents avoidance behaviour and people will stay longer in a certain environment. Hirsch (1995) studied the influence of environmental scent in slot machine areas in a casino. The study examined the amount of money visitors were spending in conditions with or without added scent. These results showed that visitors were willing to spend more money in conditions with added scent. Only little research examined the interaction effects or combined implementation of environmental features (Morrison, Gan, Dubbelaar & Oppewal, 2011). Morrison et al. (2011) tested the effects of music (volume high or low) and scent (vanilla scent

present/absent) on young fashion shoppers. The researchers found that interaction between music and the presence of vanilla scent had a positive effect on shoppers' feelings of pleasure and time spend in a store.

The distinctive feature of this research project is that it focused on the combined application of colour and scent. Thereby, there has been no research into the combined influence of colour and scent, based on arousal congruence, on people's mood and cognitive performance.

1.3 Overview of the report

The first chapter introduces the subject, background, purpose and scientific and practical relevance of the research project, as well as an overview of this report. In chapter two, the theoretical framework presents relevant literature related to atmospherics, the Gestalt principle, arousal congruence, processing fluency and the two chosen environmental features, colour and scent. Also the dependent variables mood and cognitive performance and the possible moderator sensation seeking will be presented. Finally, a schematic overview will be given of all variables that were relevant in the research project. Chapter three presents the research methodology. First, the main research question and hypotheses will be described. Second, the two pre-tests of colour and scent and the field experiment are further explained. Also several legal and ethical considerations are presented in this chapter. The results of the field experiment will be presented in chapter four. Then, in chapter five, a discussion about the results, presented in chapter four, is illustrated. Hereby also limitations of the research project and suggestions for future research will be specified. At last, in chapter six, conclusions are drawn by answering the main research question and giving suggestions for practical implementation.

2. Theoretical framework

In this chapter relevant literature related to atmospherics, Gestalt principle, arousal congruence and processing fluency will be discussed. Additionally, both environmental features, colour and scent and combinations between environmental features are considered. Furthermore, the dependent variables mood and cognitive performance are analyzed. This is followed by description of a possible moderator: sensation seeking. Finally, a schematic overview is given of all variables that were relevant in this research project.

2.1. Atmospherics, Gestalt principle, arousal congruence and processing fluency

2.1.1. Atmospherics

The physical environment consists of a variety of tangible and intangible environmental features that may affect people's emotions and behaviour. These environmental features are also known as atmospherics like furnishings, colour, lighting and scent. Atmospherics have been studied in the fields of marketing, retail and hospitality, but less frequently in business contexts. In the field of marketing, Kotler (1973) defined atmospherics as conscious designing of space to produce specific emotional effects in buyers that enhance their purchase probability. Related to the concept of atmospherics, Bitner (1992) developed a conceptual framework that addresses the effects of the physical environment on consumers in service settings. She differentiated dimensions of the physical environment into ambient conditions, space/function and signs, symbols and artefacts. Ambient conditions are intangible background characteristics of an environment (i.e. temperature, colour and scent). These environmental features affect people's senses but may also have subconscious effects. Space/function are the ways in which equipment and furnishings are arranged within an environment and how they facilitate performance. Signs, symbols and artefacts serve as explicit or implicit signals that communicate about an environment to its users (Bitner, 1992). She supposed that these elements together affect the perception and behaviour (approach/avoidance) of individuals. Approach behaviours include exploration, staying longer, commitment, and carrying out a plan, while avoidance behaviours are the opposite (Bitner, 1992). According to the dimensions of Bitner (1992), this study examined the influence of two ambient conditions (colour and scent) on people's mood and cognitive performance in meeting rooms.

Harris, Ross, McBride and Curtis (2002) also distinguished three dimensions of the physical environment: architectural features, interior design features and ambient features. Architectural features are the most permanent in an environment (i.e. room size and window placement). Interior design features are not permanent and can be changed, examples include wall colour and furniture. Ambient features can be changed very easily. Lights, scents, temperature and music are examples of these features. According to the dimensions of Harris et al. (2002), this study examined the influence of an interior design feature (colour) and an ambient feature (scent) on people's mood and cognitive performance in meeting rooms.

2.1.2 Gestalt principle

According to Lin (2004), the Gestalt principle is particularly suitable for studying the effects of environmental features on behaviour. The term 'Gestalt' is derived from German and implies 'a whole configuration' (Koffka, 1935). It explains how mental images are created by combining visual, olfactory and auditory inputs and how people organize these images. According to the Gestalt principle, a perception cannot be decomposed into its elementary parts and it assumes that the basic components of perception are the perceptions themselves (gestalts). The fundamental idea of the Gestalt principle is that the whole is different from the sum of its parts (Koffka, 1935). All environmental features are grouped together in order to form a coherent impression of an environment that subsequently determines the responses of people. So, an individual's satisfaction upon entering an environment is not based on a single environmental feature. Spangenberg, Grohmann and Sprott (2005) provided evidence for the application of the Gestalt principle in a retail environment by concluding that people respond positively to an environment when features in the environment are congruent. This is in line with research by Cialdini (1993), he implied that in everyday life, people look for congruence and avoid incongruence as much as possible.

2.1.3 Arousal congruence

Congruence between environmental features is defined as a degree of similarity between properties of two or more environmental features (Mattila & Wirtz, 2001). A main characteristic of environmental features is their arousing quality. Arousal can be divided into positive and negative

arousal. Positive arousal concerns positive stimulation, for example caused by stimulating music. On the other hand there is negative arousal that causes negative feelings such as stress and anxiety. In this research project, positive arousal is used and described as a subjective feeling state that refers to the extent a person is excited, stimulated or activated in a specific situation (Mehrabian & Russell, 1974). It is assumed that an environment elicits a positive affective response when the environmental features are congruent in terms of arousal (Mattila & Wirtz, 2001). A positive affective response may lead to positive behavioural responses such as higher levels of approach behaviour. A negative affective response produces adverse behavioural responses such as higher levels of avoidance behaviour.

Mattila and Wirtz (2001) studied the interaction effects of music and scent in a retail setting. They manipulated the level of arousal and found that participants experienced an increased positive affect when exposed to 'matching' environmental features (i.e. high-arousing scent and high-arousing music). Incongruence (i.e. high-arousing scent and low-arousing music) led to poorer evaluations of the store environment, more negative behavioural responses and lower satisfaction levels.

2.1.4 Processing fluency

The processing fluency theory of Reber, Schwarz and Winkielman (2004) is about the ease with which information is processed in the human mind. It assumes that features that can be processed more easily will be evaluated more positively and lead to more favorable attitudes. Applying the idea of processing fluency to the domain of congruence, it is expected that congruent features generate greater affect, which will influence related attitudes and behaviours.

Processing fluency has been examined increasingly in recent years. For example, Landwehr, Labroo and Herrmann (2011) found that car brands, with car designs that were easier to process, showed higher sales rates. Processing fluency has also been applied to the design of packaging. Van Rompay and Pruyn (2011) examined the effects of shape-typeface congruence of packaging (water bottles) on aesthetic evaluations and value perceptions. The aforementioned researchers argued that congruence may also facilitate processing fluency and contribute to positive evaluations of products and their corresponding brands. According to Hekkert (2006), the

reason why congruent features are preferred over incongruent features is that products high in congruence are expected to ease impression formation, in contrast to products low in congruence. Findings in the study of Van Rompay and Pruyn (2011) showed that congruent shape-typeface combinations were seen as more attractive and elicited higher price expectations compared to incongruent shape-typeface combinations.

According to Herrmann, Zidansek, Sprott and Spangenberg (2012), literature regarding the effects of environmental features is interpretable from the perspective of processing fluency. As described before, findings in a study of Mattila and Wirtz (2001) stated that congruence between scent and music led to an increased positive affect. Thereby, incongruence between these environmental features led to more negative behavioural responses and lower satisfaction levels. The results are consistent with the idea of processing fluency, as congruence is more fluent for consumers to process. Based on the processing fluency theory, congruence between environmental features may lead to better processing which results in improved mood and enhanced cognitive performance of individuals in meeting rooms.

2.2 Colour, scent and combined effects

2.2.1 Colour

Colour can be distinguished in hue, brightness and saturation (Valdez & Mehrabian, 1994). Based on hue, colours are broadly divided into cool and warm colours. Cool colours are also known as colours with short wavelengths (i.e. violet and blue). Warm colours are also known as colours with long wavelengths (i.e. red and orange). There exists a hierarchy in colour from violet, blue and green (short-wavelength colours) to yellow, orange and red (long-wavelength colours) (Crowley, 1993). Brightness and saturation also play an important role in the perception of colour. Brightness determines the lightness or darkness of a colour. Much light reflection indicates a light colour, low light reflection indicates a dark colour. Saturation points to the purity of a colour: high saturation represents a pure colour and low saturation a pale, greyish colour. Colours are seen as more pleasant by an increase of both characteristics (Camgöz, Yener & Güvenç, 2002; Crozier, 1996). Hemphill (1996) proved that bright colours are associated with positive feelings such as happiness, joy and hope. Grandjean (1973) also suggested that brighter colours are judged as being friendlier,

more cultured, pleasant and beautiful. In contrast, dark colours can evoke negative feelings, such as boredom and sadness (Camgöz et al., 2002).

Elliot and Maier (2007) found that colour may evoke associations and reactions. According to the researchers, the meaning of colour is bipartite. First, the meaning of colours can be a result of learned associations, for example red, orange and green colours on traffic lights. Second, the meaning of colours can be determined by nature (i.e. associations between black and death). Tofle, Schwartz, Yoon and Max-Royale (2004) also argued that emotional reactions evoked by colour are results of learned associations based on culture and characteristics of an individual.

Wexner (1954) examined the associations between colour and mood. Participants were faced with coloured cards and asked to indicate associations with different moods. Cool colours were associated with calm, serene and comfortable moods. In contrast, warm colours were associated with stressful and exciting moods. However, the participants in the study were only exposed to coloured cards and not actually located in a coloured environment. According to Wexner (1954), there is a relationship between wavelength and level of arousal. These findings were later confirmed by Valdez and Mehrabian (1994) who found that long-wavelength colours were more arousing than short-wavelength colours.

Kwallek, Woodson, Lewis and Sales (1997) examined the influence of colours red, blue and white on people's mood and productivity in office-settings. The stimulus screening ability of people was hereby taken into account. Some individuals are able to effectively reduce the complexity of an environment (high-screener), where others are not capable of this information reduction (low-screener) (Mehrabian, 1977). They found that individuals who worked on a business task in a red environment scored higher on stress and anxiety. Compared to high-screener, low-screener experienced more depression-related feelings in red and white environments. The low-screener also performed poorer on the task in a red environment but better in a blue environment when compared to the high-screener.

Stone (2003) manipulated environmental colour and examined the effects on performance while working on a high demanding task or a low demanding task. When working on a low demanding task, people performed poorer in a blue environment compared to a red one. However, when performing a high demanding task in a blue environment, people performed better compared

to a red environment. So, performance appears to be affected by environmental colour. Mehta and Zhu (2009) demonstrated that a warm colour (compared to a cool colour) induced primarily avoidance motivation and that it enhanced performance on a detail-oriented cognitive task, whereas a cool colour enhanced performance on a creative cognitive task.

Bellizzi and Hite (1992) studied the influence of blue and red on shopping behaviour in a furniture store. The results showed that people felt more comfortable in a blue store environment compared to a red store environment. In addition, Yildirim, Akalin-Baskaya and Hidayetoglu (2007) examined the influence of violet (cool) and yellow (warm) wall colours in a cafe/restaurant. Also in this case, the cool colour was perceived as more pleasant.

Colours have the ability to attract attention, this is called the approach orientation of colour (Bellizzi, Crowley and Hasty, 1983). Retailers can use this to elicit approach behaviour. Research of Bellizzi and Hite (1992) showed that in a blue shopping environment, compared to a red one, people were more willing to look around and buy products. In a less distracting blue environment also less purchasing decisions are postponed and more money was spent. Bellizzi, Crowley and Hasty (1983) examined approach behaviour and attractiveness of different colours in an experimental study. The study measured the distance and angle at which participants were sitting down relative to a coloured wall. Results of this study indicated the opposite of the aforementioned findings, which is that people were attracted to warm colours. So, it is necessary to conduct more research since the findings in the literature are inconsistent.

2.2.2 Scent

Nowadays, retailers also use scent to influence consumers. Use of scent resulted for example in more time spent in a jewellery store and a sales increase of 300% in a bakery (Knasko, 1989). Smell is seen as the sense with the strongest connection to the emotional centre of the brains (Mitchell, Kahn & Knasko, 1995). Pleasing (and non-pleasing) scents have been found to produce easily positive (and negative) memories (Ehrlichman & Halpern, 1988). So, scents associated with specific experiences in the past are able to recall memories for many years.

Various psychological processes such as mood, cognition, person perception and sexual behaviour may be affected by scent (Pressly & Heesacker, 2001). Scent has also different

influences on both genders and on different age groups. Koelega (1994) found that females have more developed schemas with regard to olfactory cues and a heightened sensitivity to scents compared to males. Next, with the help of magnetic resonance imagery techniques, Wang, Esinger, Smith and Yang (2005) found that older individuals have the same areas of the olfactory cortex activated when exposed to lavender and mint scents, but they demonstrated lower activation volume and intensity in those areas, indicating weakened olfactory capacities.

Environmental scent is defined as a scent that does not come from a specific product, but is present in the environment (Spangenberg, Crowley & Henderson, 1996). Research by Spangenberg et al. (1996) examined the influence of environmental scent on shopping experience. Results showed that participants in a scented condition (ginger, lavender, mint and orange) experienced more pleasure compared to the control group where no scent was added. This resulted in a more positively evaluated store environment and approach behaviour.

A study of Moss, Cook, Wesnes and Duckett (2003) assessed the olfactory impact of lavender and rosemary on cognitive performance and mood. Lavender produced a decrement in performance of working memory and impaired reaction times for both memory and attention based tasks compared to the control group. In contrast, rosemary produced a significant enhancement of performance for overall quality of memory but produced also an impairment of speed of memory compared to the control group. With regard to mood, both the control and lavender groups were less alert than the rosemary group. The control group was also significantly less content than the rosemary and lavender groups. These findings indicate that olfactory properties of these scents can produce effects on cognitive performance, as well as effects on mood. Moss, Hewitt, Moss and Wesnes (2008) provided further evidence for the impact of scents on cognition and mood. Peppermint (high-arousing) was found to enhance memory whereas ylang-ylang (low-arousing) impaired it and lengthened processing speed. Thereby, peppermint increased alertness and ylang-ylang decreased it. This is consistent with findings of Raudenbosch, Grayhem, Sears and Wilson (2009), they found that peppermint stimulates the central nervous system and positively affects motivation and alertness during a driving task.

The influence of scent on another aspect of cognitive performance, namely recall and recognition, is examined by Morrin and Ratneshwar (2003). They concluded that people in scented

conditions took more time to learn brand names of sunscreen products. In addition, the researchers found that the presence of scent improved recall and recognition of the brand names.

Lehrner, Marwinski, Lehr, Johren and Deecke (2005) investigated to what extent lavender or orange scents affected anxiety, mood, alertness and calmness of dental patients. While waiting for dental procedures patients were faced with either a lavender or orange scent. Compared to the control condition, both ambient scents reduced anxiety and improved the mood of patients. Diego, Jones, Field, Hernandez-Reif, Schanberg, Kuhn, Galamaga, McAdam and Galamaga (1998) assessed EEG activity, alertness and mood of people using lavender (low arousing) and rosemary (high arousing) aromatherapy. The lavender group showed less depressed moods and reported feeling more relaxed and performed math computations faster and more accurately. The rosemary group showed increased alertness. They also reported feeling more relaxed and they were only faster, not more accurate, at completing math computations after the aromatherapy session. Besides rosemary and peppermint also lemon (Rhind, 2009, p. 289), green apple (Lindh, Pooler, Tamparo & Dahl, 2009, p. 46) and eucalyptus (Alexander, 2010, p. 36) are seen as high-arousing scents. On the other hand, besides lavender and vanilla (Aftel, 2005, p. 59), also rose (Ross, 2007) and sandalwood (Ross, 2010) are considered as low-arousing scents.

Some scents are generally perceived as pleasant but can be seen as inappropriate in a particular context. Pomerantz (1981) suggested that a misfit between scent and a product may lead to contradictions between different cognitive resources. This in turn may result in inadequate assessment of the product or environment. Mitchell et al. (1995) examined the relationship between scent and product type. This research showed that congruence between scent and product type will positively influence the decision making process of consumers. Also a study of Spangenberg et al. (2005) pointed at the importance of a fit between scent and components of the environment in which it is used. The study found that a 'Christmas scent' was reviewed more positively in case Christmas music was played.

Spangenberg, Sprott, Grohmann and Tracy (2006) examined the influence of scent on odourless products like clothing. The use of a 'fitting' scent, which may vary by product, may also lead to positive results for odourless products. Scents do not necessarily need to be associated directly with products. A scent can also fit products because of congruence with other elements like

gender of the customer. According to Spangenberg et al. (2006), retailers who do not have scents inherently congruent with their product offerings have to find other forms of congruence.

2.2.3 Combined application of environmental features

Aesthetic experiences do not arise in a vacuum. In case there is an unpleasant scent, it might have an effect on the perception of other environmental features. So, it is likely that effects of different environmental features have strengthening or weakening effects on each other (Dijkstra, 2009). Because of this, a number of studies which examined the combined application of environmental features are discussed in this section.

There has been little research into the combined application of colour and scent in retail or business settings. In a study of Babin, Chebat and Michon (2004) about the perceptual appropriateness of colour, scent and music, the perceived quality, affective response and approach and avoidance behaviour of consumers in a shopping mall were measured. Results showed that matching environmental features positively affected the quality perception, affective reactions and finally the actual behaviour of consumers. The findings also suggested that when the perceptual appropriateness was reduced, consumers reported lower product quality ratings, lower affective responses and they exhibited approach behaviour to a lesser extent.

Next, Cottet, Plichon and Lichtlé (2007) compared the effects of colour, scent and music on emotions felt in a store, satisfaction and return intentions. According to these authors, it is important to ensure congruence between scent, store image and store layout to positively influence customers' emotions and their satisfaction. Thereby they stated that colours need to be congruent with other environmental features to increase loyalty and to generate return intentions. In summary, Cottet et al. (2007) emphasized the importance of congruence between environmental features to influence emotions and behaviour of consumers.

Few examples of combined application of colour and other environmental features have been found. Babin, Hardesty and Suter (2003) tested the combined effects of colour and lighting in a scenario-based retail setting. Results showed that a cool interior was preferred over a warm interior and that it generated a greater willingness to buy products. However, when combined with lighting, the warm interior with soft lighting became almost as positively rated as the cool interior. In

the cool interior, the effects were even more positive in a brightly-lit condition. So effects of environmental features can nullify because of interaction with other environmental features.

Verstaen (2011) examined the impact of combined application of colour and music in a retail field setting based on a 2 (low and high-arousing colour) by 2 (low and high-arousing music) design. Results showed that when colour and music were congruent in terms of their arousing quality, consumers experienced enhanced satisfaction, exhibited higher levels of approach and impulse buying behaviour and spent more money compared to incongruent conditions. This study emphasized the importance of considering the combined application of environmental features.

Mattila and Wirtz (2001) examined combined application of scent and music. The researchers hypothesized that the environment was perceived more positively when their arousing qualities match rather than mismatch. Therefore, a distinction was made between high-arousing and low-arousing scents and high-arousing and low-arousing music. The results showed that consumers experienced the environment more positively in situations where scent and music were congruent in terms of arousal. Consumers exhibited stronger approach and impulse buying behaviour and experienced enhanced satisfaction compared to incongruent conditions. Furthermore, Michon and Chebat (2006) studied the interaction effects of music and scent on non-grocery purchases at a shopping mall. They manipulated music tempo (high or low) and scent (lemon or no scent) and varied these over time. Consumer spending was notably higher when music and scent were congruent (high tempo music/lemon scent and low tempo music/no scent). In addition, consumer spending was significantly lower in incongruent conditions (high tempo music/no scent and low tempo music/lemon scent).

2.3 Mood and cognitive performance

2.3.1 Mood

Mood is an emotional state or quality of feeling of a person at a particular time. Mehrabian and Russell (1974) developed the stimulus-organism-response model, also known as the SOR-model, in which the relationship between environmental features and mood is established. Mehrabian and Russell (1974) argued that due to the fact that individuals respond differently to environments, mood is a significant mediating factor between environmental features and cognition and

behaviour. The SOR-model proposes that external features in the environment (S) influence internal evaluations of individuals (emotions) (O) that finally result in behavioural changes (R). In the environmental psychology, mood is classified in three dimensions that represent pleasure, arousal and dominance (PAD). Pleasure is the degree to which a person feels comfortable in an environment. Arousal is the degree to which a person is stimulated by the environment. Finally, dominance is the degree to which a person has a sense of control over the situation. Behaviour is split up in approach and avoidance behaviour. Approach behaviour concerns positive behaviour evoked by the environment, such as desire to stay and to return to an environment. Avoidance behaviour concerns negative behaviour evoked by the environment, such as desire to leave and not willing to return to an environment (Van Hagen, 2011).

There is a basic level of environmental stimulation at which an individual feels comfortable. The degree at which a person feels comfortable depends on various factors, for example gender. According to Meyers-Levy and Maheswaran (1991), females are more detail-oriented and therefore show a greater sensitivity to environmental features which generally leads to preference for lower arousal levels. According to Berlyne (1971) and Mehrabian and Russell (1974), there is a relationship between pleasure and arousal which has the shape of an inverted U. Situations with high or low arousal are seen as less pleasurable compared to situations with a moderate level of arousal (Mehrabian & Russell, 1974). Therefore it is important to include the effects of pleasure in studies where arousal is tested (Russell & Mehrabian, 1976). Apter (2007) assumes that it is the optimal presentation of environmental features for a specific task that leads to an optimally pleasant experience. Too high or too low stimulation may result in discomfort and negative feelings. Too high stimulation as a result of for example exposure to bright lighting may lead to feelings of stress. Too low stimulation as a result of for example exposure to too greyish colours may cause bored feelings.

The reversal theory of Apter (2007) elaborates on the optimal arousal theory. The reversal theory indicates that it depends which level of stimulation is preferred: high or low. The state in which people are situated determines the level of stimulation required. On the one hand, people in the telic state are serious, focused and result-driven (low arousal required). People in the paratelic state, on the other hand, need stimulation and are light-hearted and spontaneous (high arousal

required). Conflicts between the desired state and the actual state may lead to avoidance behaviour. Approach behaviour will occur in case both states are congruent (Apter, 2007). Thereby it is possible that people change from the telic state to the paratelic state or vice versa (Apter, 2007).

2.3.2 Cognitive performance

Cognitive performance indicates abilities and skills from the psychological functional ranges of perception, attention, learning and retention, thinking and intelligence, and psychomotor activity (Committee for geriatric diseases and asthenias, 1986, p. 49). As can be derived from the definition, cognitive performance is not based on a particular value such as intelligence but rather on a combination of several cognitive functions. The level of cognitive performance can be seen as a personal characteristic. According to Budde and Barowsky (2008), the level of cognitive performance is influenced by three types of variables: situation-specific variables (i.e. environmental features), task-specific variables (i.e. complexity) and individual-specific variables (i.e. health status, affective state, motivation or nutrition). Various variables are likely to differ within a short timeframe and may change completely in their impact on cognitive performance. Cognitive performance is based on conscious and unconscious processes (Cooper & Pervin, 1998, p. 441). Conscious processes happen mainly under control of individuals. Unconscious processes on the other hand, can monitor for other thoughts and other emotional states one might experience. The conscious processes are only just a small part of mental functioning, cognitive performance is mostly based on unconscious processes.

Eysenck and Calvo (1992) examined if mood negatively affects the cognitive performance in an environment. When an individual, for example, is highly anxious, he or she needs more resources to achieve a particular performance level compared to a person who is not. This may result in negative effects on cognitive tasks that are already demanding. Also Seibert and Ellis (1991) found that people experience emotional mood changes and that these influence their cognitive performance. Mood states have been shown to influence cognitive processes in a variety of ways. Research showed that mood states are related to alterations in social and personal judgments, alterations in spatial judgments and recall impairment (Seibert & Ellis, 1991). According

to Hirt, Melton, McDonald and Harackiewicz (1996), a positive mood enhances performance on creative tasks, but causes impairment of performance on tasks that require more detailed processing. On the other hand, a negative mood seemed to facilitate detailed processing.

2.4 Sensation seeking

The effects of environmental features on individuals were expected to be moderated by personal traits. A trait that might be related to the way people perceive an environment is sensation seeking. Sensation seeking is defined as “the seeking of varied, novel, complex, and intense sensations and experiences, and the willingness to take physical risks for the sake of such experiences” (Zuckerman, 1994, p. 27). So, for high sensation seekers, experiencing an exciting event is the most important and the willingness to take risks is a result of this sensation seeking process. Larsen and Buss (2008, p. 223) stated that high sensation seekers require more stimulation to reach their optimal level of arousal and to avoid boredom and unpleasant experiences. High sensation seekers are less tolerant of sensory deprivation and compared to low sensation seekers, they are more likely to use drugs, to become involved in sexual experiences and to volunteer for high-risk activities and unusual experiments (Roberti, 2004). High sensation seekers tend to have a preference towards complex, ambiguous and intense stimuli because these are high in arousal, while low sensation seekers tend to prefer low arousal stimuli (Zuckerman, 1994). The nervous system of low sensation seekers blocks stimuli to protect against abundance (Zuckerman, 1990). Also Roberti (2004) stated that high sensation seekers are more open to external stimulation, for example from sources in the environment.

The sensation seeking scale consists of four subscales: thrill and adventure seeking (TAS), experience seeking (ES), disinhibition (DIS) and boredom susceptibility (BS). TAS is characterized by the desire to perform physical activities with speed and danger. ES indicates the desire for seeking new personal experiences. The component DIS is the expression of reduced social restraint. BS is a person’s dislike for routine and predictable processes (Hittner & Swickert, 2006).

Research by Mobini, Pearce and Grant (2006) showed a correlation between sensation seeking and impulsivity. Impulsivity can be described as a failure to resist an impulse which is

harmful to the individual itself or to others. Impulsive people reported higher sensation seeking behaviours as a result of shortcomings in their impulse control (Hollander & Evers, 2001).

Carton, Jouvent, Bungener and Widlocher (1992) found a relation between mood and sensation seeking. Depressed persons scored significantly lower on sensation seeking compared to non-depressed persons. These findings were later confirmed by research of Farmer, Redman, Harris, Mahmood, Sadler and McGuffin (2001), they also concluded that low mood is associated with lower scores on sensation seeking.

2.5 Schematic overview

Figure 2.1 gives a schematic overview of all variables in this research project. The model includes environmental features colour and scent as independent variables, also in combined application based on arousal congruence. Mood and cognitive performance were dependent variables and sensation seeking, gender, age and education possible moderators. Arousal was seen as a possible mediator.

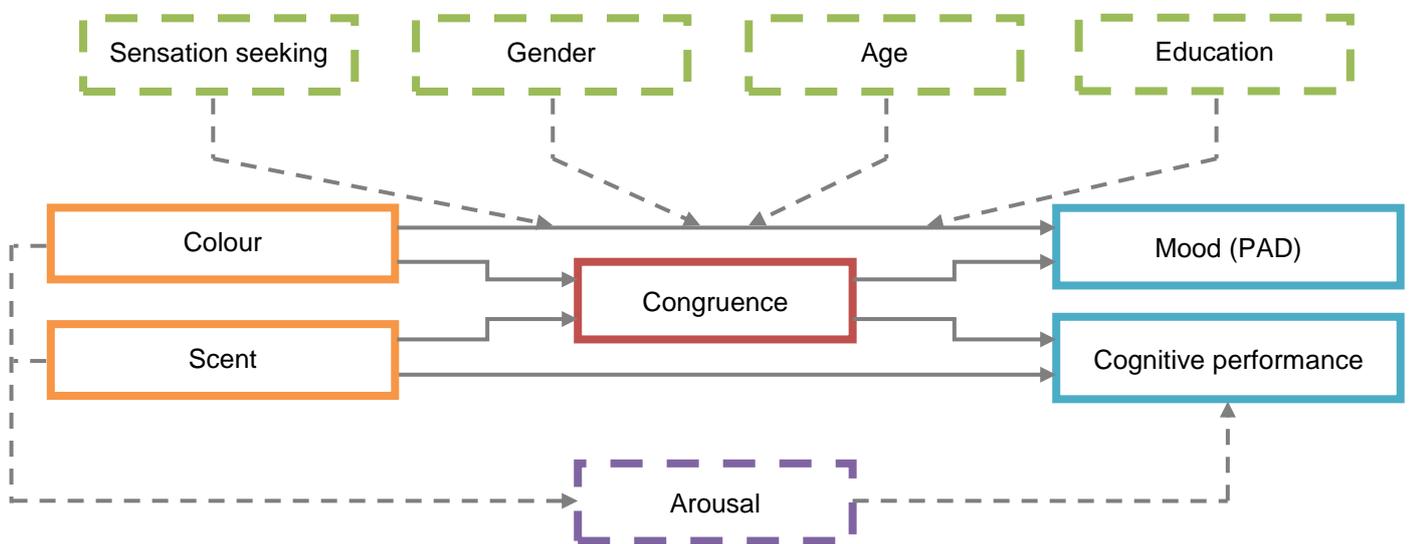


Figure 2.1: Schematic overview variables research project

3. Research methodology

This chapter presents the research methodology and starts with an explanation of the main research question and hypotheses. Subsequently, the colour and scent pre-tests will be described. Next, the field experiment will be further explained by means of the purpose and design of the experiment. Also the target group, participant selection, procedure of data collection will be elucidated. Finally, the cognitive performance test and questionnaire and the legal and ethical considerations will be clarified.

3.1 Main research question and hypotheses

By means of testing hypotheses, this research project examined the influence of colour and scent, also in combined application based on arousal congruence, on people's mood and cognitive performance in meeting rooms. Thereby it was checked if arousal worked as a mediator and sensation seeking, gender, age and education as moderators. The main research question was: *To what extent do colour and scent, also in combined application based on arousal congruence, affect people's mood and cognitive performance in meeting rooms?* The following hypotheses, which are based on findings in existing literature, have been formulated to answer the main research question:

H1: The use of cool colours, compared to warm colours, leads to improved mood (H1a) and enhanced cognitive performance (H1b) of individuals in meeting rooms.

H2: The use of relaxing scents, compared to stimulating scents, leads to improved mood (H2a) and enhanced cognitive performance (H2b) of individuals in meeting rooms.

H3: Congruence between colour and scent (high/high and low/low arousing conditions) leads to improved mood (H3a) and enhanced cognitive performance (H3b) of individuals in meeting rooms compared to incongruence between colour and scent (high/low and low/high arousing conditions).

H4: The level of arousal mediates the effects of colour and scent on cognitive performance of individuals in meeting rooms.

H5: Sensation seeking moderates the effects of colour and scent on mood (H5a) and cognitive performance (H5b) of individuals in meeting rooms.

H6: Sensation seeking moderates the effects of combined application of colour and scent, based on arousal congruence, on mood (H6a) and cognitive performance (H6b) of individuals in meeting rooms.

H7: Gender, age and education moderate the effects of colour and scent on mood (H7a) and cognitive performance (H7b) of individuals in meeting rooms.

H8: Gender, age and education moderate the effects of combined application of colour and scent, based on arousal congruence, on mood (H8a) and cognitive performance (H8b) of individuals in meeting rooms.

3.2 Pre-tests colour and scent

Before the main study was carried out, two pre-test were conducted to determine which colours and scents should be used in the study.

3.2.1 Colour pre-test

The colour pre-test included five warm colours and five cool colours. The warm colours, perceived as high arousing, were orange, yellow, brown, red and pink. The cool colours, perceived as low arousing, were green, violet, silver grey, blue and grey. By means of a questionnaire it was found which colour was perceived as the most pleasant high-arousing colour and what colour was perceived as the most pleasant low-arousing colour.

The questionnaire started with a written introduction about the researcher and the experiment. Subsequently, several instructions about the procedure of the pre-test were given. The questionnaire consisted of two parts, part A and B. At part A, participants had to fill in their gender and age. At part B, participants were shown randomly ten pictures of a meeting room with coloured walls on a 17" laptop screen in a canteen of the University of Twente (see appendix A). Before starting with the procedure, participants were asked to write down the letter (A-J) from the document title. For each coloured meeting room, at which they looked for 30 seconds, they had to specify their feelings with the help of the dimensions pleasure and arousal, two dimensions of the PAD-scale of Mehrabian and Russell (1974). At the dimension pleasure, participants answered 6 items on a 7-point scale, for example the degree of satisfaction from 'unsatisfied' to 'satisfied'. Also at the dimension arousal, participants answered 6 items on a 7-point scale, for example the degree of excitement from 'calm' to 'excited'. Even though all other aspects in the meeting rooms remained unchanged, participants have been instructed to only specify their feelings regarding the colour of the meeting

room. The questionnaire can be found in appendix B.

In total, 25 people participated in the pre-test, consisting of 11 males (44%) and 14 females (56%). The mean age was 23.30 years ($SD = 4.30$) in the age category of 18 - 36 years.

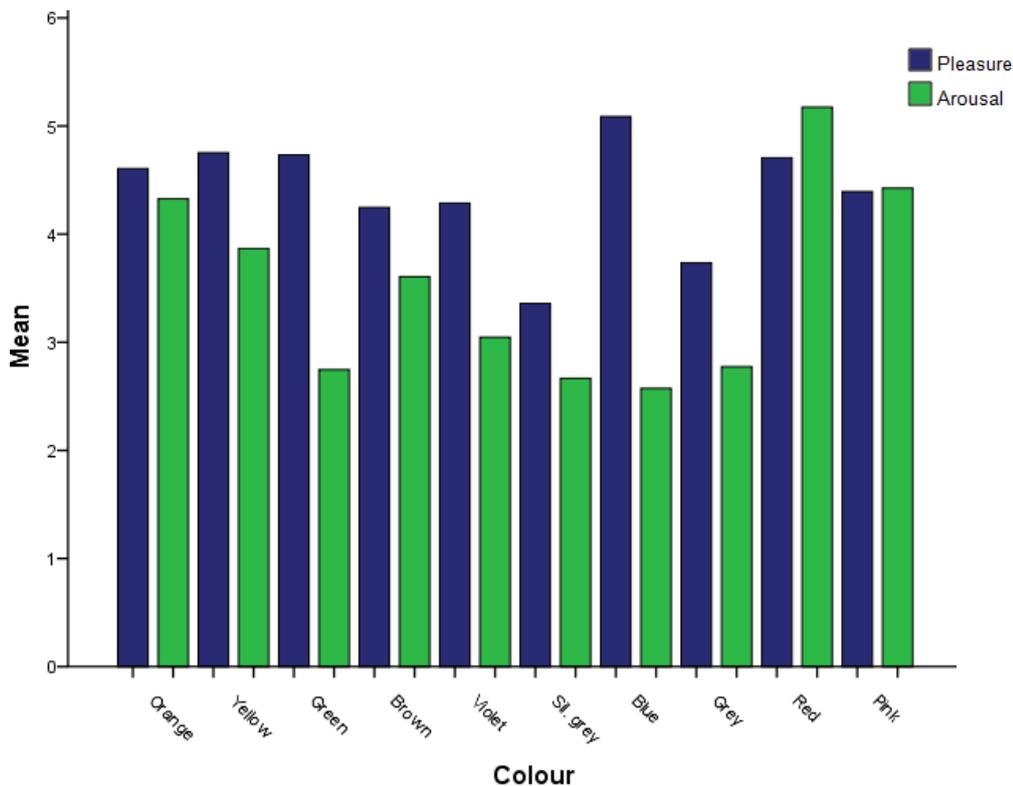


Figure 3.1 Mean scores colours on pleasure and arousal

Figure 3.1 presents the mean scores of the colours on pleasure and arousal. On the degree of arousal, red ($M = 5.17$, $SD = .51$) scored significantly higher than the other warm colours. Both, green ($M = 2.75$, $SD = .58$) and blue ($M = 2.57$, $SD = .48$), scored significantly lower than the other

cool colours. No differences were found on the degree of pleasure between warm colours yellow ($M = 4.75$, $SD = .83$) and red ($M = 4.71$, $SD = .85$), $t(24) = .196$, *ns*. There were also no differences on the degree of pleasure between the cool colours, green ($M = 4.73$, $SD = .84$) and blue ($M = 5.09$, $SD = .73$), $t(24) = 1.95$, *ns*. As a result, red is used as the high-arousing colour in the main study. Concerning the low-arousing colour, blue and green could both function as the low-arousing colour in the main study. However, blue is more often used as a cool colour in the literature. For that reason there is more affirmation concerning the arousal reducing properties of this colour (Kwallek et al., 2007; Mehta & Zhu, 2009). Based on this fact, blue is used as the low-arousing colour in the main study. Differences in pleasure and arousal between the other colours can be found in appendix C.

3.2.2 Scent pre-test

In the second pre-test eight scents were evaluated. The four scents perceived as high arousing were peppermint, lemon, eucalyptus and green apple. The four scents perceived as low arousing were sandalwood, vanilla, lavender and rose. By means of a questionnaire it was found what scent was perceived as the most pleasant high-arousing scent and what scent was perceived as the most pleasant low-arousing scent. The questionnaire started with a written introduction about the researcher and the experiment. Subsequently, several instructions about the procedure of the pre-test were given. The questionnaire consisted of two parts, part A and B. At part A, participants had to fill in their gender and age. At part B, participants had to smell randomly eight scent oils on cottons in identical sealable cups in a canteen of the University of Twente (see appendix D). Before starting with the procedure, participants were asked to write down the letter (A-H) which was placed on the front of every cup. Once opened the cover, they had to hold the cup 10 to 15 cm from their nose and had to make five 'wave gestures' towards their nose. After each scent, they had to specify their feelings with the help of the dimensions pleasure and arousal, two dimensions of the PAD-scale of Mehrabian and Russell (1974). At the dimension pleasure, participants answered 6 items on a 7-point scale, for example the degree of satisfaction from 'unsatisfied' to 'satisfied'. Also at the dimension arousal, participants answered 6 items on a 7-point scale, for

example the degree of excitement from 'calm' to 'excited'. After each scent they were asked to smell at their own skin to 'neutralize' their nose. The questionnaire can be found in appendix E.

The total number of participants was 25 and consisted of 9 males (36%) and 16 females (64%). The mean age was 21.80 years ($SD = 2.80$) in the age category of 18 - 30 years.

Figure 3.2 presents the mean scores of the scents on

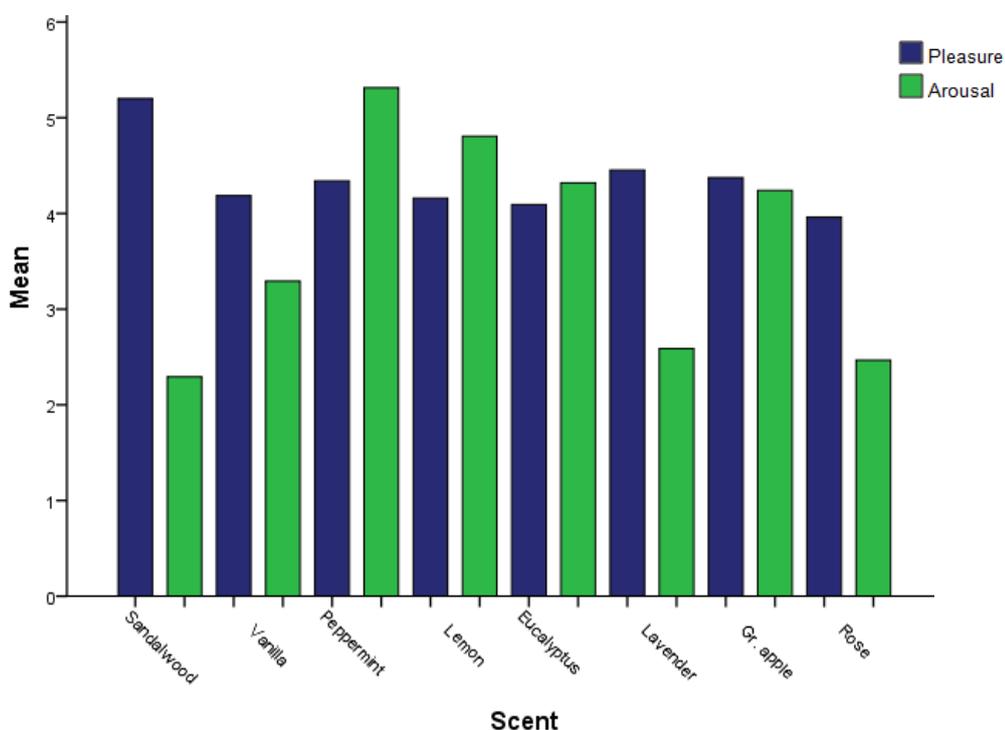


Figure 3.2 Mean scores scents on pleasure and arousal

pleasure and arousal. In this pre-test, peppermint ($M = 5.31$, $SD = .56$) scored significantly higher on arousal than the other high-arousing scents. In contrast, no differences were found in the degree of pleasure between the four high-arousing scents (peppermint, lemon, eucalyptus and green apple). As a result, peppermint is used as the high-arousing scent in the main study. Concerning the low-arousing scent, sandalwood ($M = 5.20$, $SD = .70$) scored significantly higher on pleasure and significantly lower on arousal ($M = 2.29$, $SD = .43$) (except for rose), so this scent is used as the low-arousing scent in the main study. Differences in pleasure and arousal between the other scents can be found in appendix F.

3.3 Main study in a meeting room

3.3.1 Purpose and design

The purpose of the field experiment was to examine the (combined) application of colour and scent on people's mood and cognitive performance in meeting rooms. The combined application of both environmental features is based on arousal congruence. From the previously described colour pre-test (§ 3.2.1) it turned out that respectively red and blue had to be used as the high-arousing and

low-arousing colours. The scent pre-test (§ 3.2.2) showed that respectively peppermint and sandalwood were most suitable for use as the high-arousing and low-arousing scents.

Four colour-scent conditions were applied in a meeting room in the village Lievelede. In the first condition, blue wall colour and sandalwood scent were combined in the meeting room (arousal congruence). In the second condition, the meeting room was provided with blue wall colour and peppermint scent (arousal incongruence). In the third condition, red wall colour and peppermint scent were implemented in the meeting room (arousal congruence). Finally, the meeting room was provided with red wall colour and sandalwood scent (arousal incongruence). Due to the fact this experiment did not make use of a control group, at least thirty participants had to participate per condition. So, at least one-hundred-twenty participants had to be approached.

3.3.2 Target group, participant selection and procedure of data collection

As previously described, the field experiment took place in a meeting room in Lievelede. In the period from 4 February 2013 till 15 March 2013, the target group consisting of the working population in the age category of 18 - 65 years participated in the field experiment. Data collection took place seven days a week from 10:00 till 20:00.

Prior to the data collection, preparation of the meeting room was needed. First, to colour the walls, a blue cloth of six by two meters was spanned on two walls. For the other two conditions, a red cloth of the same size was used. Second, referring to scent, a scent diffuser with sandalwood scent was placed in the room, out of sight of the participants. For the other two conditions, a scent diffuser with peppermint scent was placed in the room. After one day, when the scent was diffused in the room, ten participants took part in a pilot study to test the strength of the scent, five in the sandalwood condition and five in the peppermint condition. It became clear no extra scent diffuser had to be used. Because of the room size of twelve square meters, adding extra scent would be too intensively. In other to keep the other environmental features in the meeting room constant, the temperature in the room was 20 degrees Celsius and the blue or red curtains were closed all day. There was only made use of artificial light from a ceiling light and a desk lamp. In appendix G, pictures of the meeting rooms can be found.

By appointment, the participants registered themselves at the meeting room. Next, the participants went into the meeting room, together with the researcher, where they had to fill in an Ishihara's test to detect for colour blindness (appendix H). In the case participants did not suffer from colour blindness, they received the cognitive performance test with a pen and some verbal instructions. In approximately twenty minutes, the participants finished the cognitive performance test and went on with the digital questionnaire. This questionnaire was displayed on a 17" laptop screen and completing lasted about ten minutes. After completing the questionnaire, participants were thanked for their cooperation. When at least thirty participants filled in the cognitive performance test and the questionnaire in one of the four experimental conditions, it was switched over to the next condition.

3.3.3 Cognitive performance test and questionnaire

The field experiment started with an introduction about the researcher and the research project. Participants were told that the purpose of the study was to examine the influence of mood on cognitive performance. The environmental features, colour and scent, were consciously excluded from the explanation. Next, instructions about the procedure of the experiment were given. It started with a scenario to emphasize the importance of performing at the cognitive performance test. The scenario was: *'You are having a job interview for a job that fully meets your requirements. As a part of the application procedure, you have to perform a cognitive performance test. It is important to score as high as possible on this test because you are convinced that you are the right person for this job.'* The introduction also served as pastime to ensure that participants experienced colour and scent at least shortly before they started with the cognitive performance test and the questionnaire.

As described before, cognitive performance is based on a combination of several cognitive functions. In this study learning and retention, attention and intelligence were examined as cognitive functions. The cognitive performance test started with the Ebbinghaus Memory Test (Ebbinghaus, 1885), a method to test learning and retention. Participants were faced two matrices, one consisting of twelve fictional three-letter words and one consisting of twelve images. In one minute per matrix, they needed to remember as much three-letter words/images and their locations

as possible. At a later point, they had to recall as much three-letter words/images and their locations as possible. The second part of the cognitive performance test consisted of the Trail Making Test (Army Individual Test Battery, 1944), a method to test attention. The Trail Making Test consisted of two parts, both preceded by a training set. At the first part, participants had to connect pre-printed numbers 1-25 as quick as possible in ascending order seamlessly. At the second part, participants had to connect pre-printed numbers 1-13 and pre-printed characters A-L as quick as possible in ascending order seamlessly as follows: 1-A-2-B-3-C etc.. The score of participants was measured in seconds needed to complete both parts. The next part contained a recall task from the Ebbinghaus Memory Test. Participants had to recall as much of the three-letter words/images and their locations as possible. The score of participants was measured in the correct number of three-letter words/images and the correct number of three-letter words/images combined with their locations. Then, the last part of the cognitive performance test was an abridged version of an intelligence test, a method to test intelligence. This test consists of ten multiple choice questions, one for each item of a regular IQ-test (Wechsler, 1944): synonyms, number series, figure series, syllogisms, cubes, editorial sums, antonyms, analogies, word meanings and composed figures. Every multiple choice question consisted of four or five response options.

After completion of the cognitive performance test, participants were forwarded to a digital questionnaire. The participants were told they could abandon the scenario and that they had to specify their mood and feelings with the help of the PAD-scale of Mehrabian and Russell (1974). This scale consisted of three dimensions: pleasure, arousal and dominance. At the dimension pleasure, participants answered 6 items on a 7-point scale, for example the degree of satisfaction from 'unsatisfied' to 'satisfied'. Also at the dimension arousal, participants answered 6 items on a 7-point scale, for example the degree of excitement from 'calm' to 'excited'. Finally, at the dimension dominance, participants also answered 6 items on a 7-point scale, for example the degree of control from 'cared for' to 'in control'.

The following part contained the 40-item sensation seeking scale of Zuckerman (1979). Participants were informed that the 40 items consisted of two possible answers, A and B. They had to indicate which of the two answers described their preferences or feelings best. As previously stated, the sensation seeking scale consists of four dimensions: thrill and adventure seeking

(TAS), experience seeking (ES), disinhibition (DIS) and boredom susceptibility (BS). An item indicating a high TAS factor was 'I often wish I could be a mountain climber' in contrast to 'I can't understand people who risk their necks climbing mountains'. An item indicating a high ES factor was 'I like some of the earthy body smells' in contrast to 'I dislike all body odours'. An item indicating a high DIS factor was 'I like 'wild' uninhibited parties' compared to 'I prefer quiet parties with a good conversation'. Finally, an item indicating a high BS factor was 'I prefer friends who are excitingly unpredictable' compared to 'I prefer friends who are reliable and predictable'.

In the last part of the questionnaire, participants were asked about their age, gender and education level. Participants were also asked if they perceived colour and/or scent. If they answered this/these question(s) with 'yes', they additionally had been asked to indicate on 7-point scales how pleasant and arousing they perceived the colour and/or scent. These questions were used as a manipulation check. Finally, the participants had to give written permission for making use of the data anonymously. The questionnaire was worded in Dutch and can be found in appendix I.

3.4 Legal and ethical considerations

Several legal and ethical recitals had to be considered. During this research project, people were asked to participate in the field experiment with no mention of any obligation. Participation in the pre-tests and the field experiment was always completely voluntary.

Research data were gathered by offering participants a cognitive performance test and by asking them about their mood, feelings and preferences whereby no mental or physical concerns were violated. Thereby, participants had the right to terminate their cooperation at any time during the research project. Anonymity was ensured throughout the whole research project. Only demographics of the participants were linked to the results of the experiments.

Contact details of the researcher were made available to the participants. In case of questions or complaints regarding the research goals, participation, results or other aspects of the experiments, they had the opportunity to contact the researcher. Participants were also asked whether they were interested in a debriefing of the pre-tests and field experiment. All the aforementioned aspects have been closely considered during the conduction of the experiments.

4. Results

This chapter describes successively the reliability analysis and the participant characteristics. Then it will be checked if the colour-scent manipulations worked out and finally the results are analyzed to determine if the hypotheses can be confirmed.

4.1 Reliability

The proposed constructs were tested for internal consistency by means of a reliability analysis (Cronbach's alpha). Table 4.1 gives an overview of the different constructs, the reliability, number of items and number of items deleted.

Table 4.1 Reliability constructs

	Cronbach's Alpha	Items	Items deleted
Pleasure	.842	6	0
Arousal	.776	6	0
Dominance	.744	6	0
Thrill and adventure seeking (TAS)	.767	10	0
Experience seeking (ES)	.564	9	1
Disinhibition (DIS)	.718	9	1
Boredom susceptibility (BS)	.737	10	0
Sensation seeking (SS)	.867	40	0

The constructs pleasure, arousal, dominance, thrill and adventure seeking, disinhibition, boredom susceptibility and sensation seeking were all acceptable. To improve the reliability of experience seeking and disinhibition, one item was removed at both constructs. Nevertheless, the reliability of construct experience seeking was still inconclusive and therefore, it was not used as a separate construct.

4.2 Participants

The total number of participants in the field experiment was 122 and consisted of 73 males (59.8%) and 49 females (40.2%). The mean age was 30.07 years ($SD = 12.57$) in the age category 18 - 56

years. Spread over the four conditions, 30 persons participated in the blue-sandalwood condition, 30 persons in the blue-peppermint condition, 30 persons in the red-peppermint condition and 32 persons in the red-sandalwood condition. Table 4.2 shows characteristics of the participants per experimental condition. It was tested if there were significant differences between the participants, however no differences were found. The sample characteristics were the same amongst all experimental conditions.

Table 4.2 Characteristics participants per experimental condition

		Arousal congruence			Arousal incongruence		
		blue/sw	red/pm	total	blue/pm	red/sw	total
Number		30	30	60	30	32	62
participants							
Age		30.53 (12.02)	29.07 (10.49)	29.80 (11.21)	32.03 (14.59)	28.72 (13.16)	30.32 (13.86)
Gender	Male	17 (56.7%)	18 (60.0%)	35 (58.3%)	15 (50.0%)	23 (71.9%)	38 (61.3%)
	Female	13 (43.3%)	12 (40.0%)	25 (41.7%)	15 (50.0%)	11 (28.1%)	24 (38.7%)
Education	Primary school	-	-	-	-	-	-
	VMBO BK	-	-	-	1 (3.3%)	-	1 (1.6%)
	VMBO GT	1 (3.3%)	1 (3.3%)	2 (3.3%)	4 (13.3%)	2 (6.3%)	6 (9.7%)
	HAVO	5 (16.7%)	2 (6.7%)	7 (11.7%)	5 (16.7%)	8 (25.0%)	13 (21.0%)
	VWO	5 (16.7%)	4 (13.3%)	9 (15.0%)	4 (13.3%)	7 (21.9%)	11 (17.7%)
	MBO	5 (16.7%)	9 (30.0%)	14 (23.3%)	7 (23.3%)	6 (18.8%)	13 (21.0%)
	HBO	11 (36.7%)	8 (26.7%)	19 (31.7%)	6 (20.0%)	7 (21.9%)	13 (21.0%)
	University	3 (10.0%)	6 (20.0%)	9 (15.0%)	3 (10.0%)	2 (6.3%)	5 (8.1%)

4.3 Manipulations

In the questionnaire, several questions were added to test if participants perceived colour and scent in the meeting room while completing the cognitive performance test and questionnaire. In the blue meeting room, 51 out of 60 participants (85.0%) indicated that they had seen colour. 8 participants (13.3%) did not perceive colour and 1 participant (1.7%) could not remember if he/she perceived colour while completing the cognitive performance test and questionnaire. If participants perceived colour, they additionally had been asked to indicate the degree of pleasantness and arousability of the colour on 7-point scale. The colour blue was seen as pleasant ($M = 5.63$, $SD =$

.94) and low arousing ($M = 2.69$, $SD = 1.33$). In the red meeting room, 56 out of 62 participants (90.3%) indicated that they had seen colour. 4 participants (6.5%) did not perceive colour and 2 participants (3.2%) could not remember if they perceived colour. The participants who had seen colour indicated the colour red as pleasant ($M = 4.96$, $SD = 1.29$) and high arousing ($M = 5.02$, $SD = 1.34$). When compared to blue, a significant difference was found in degree of pleasure, $t(100.12) = 3.06$, $p < .01$. The differences in degree of arousal between blue and red were also significant, $t(104.18) = -9.01$, $p < .01$.

In the sandalwood conditions, 46 out of 62 participants (74.2%) indicated that they had smelled scent. 11 participants (17.7%) did not perceive scent and 5 participants (8.1%) could not remember if they perceived scent. If participants perceived scent, they additionally had been asked to indicate the degree of pleasantness and arousability of the scent on 7-point scale. Sandalwood was seen as pleasant ($M = 5.15$, $SD = 1.14$) and low arousing ($M = 2.70$, $SD = 1.03$). In the peppermint conditions, 52 out of 60 participants (86.7%) indicated they had smelled scent. 7 participants (11.7%) did not perceive scent and 1 participant (1.7%) could not remember if he/she perceived scent. The participants who had smelled scent indicated peppermint as pleasant ($M = 4.77$, $SD = 1.34$) and high arousing ($M = 4.79$, $SD = 1.29$). When compared to sandalwood, no significant differences were found in degree of pleasure, $t(95.84) = 1.53$, *ns*. However, differences in degree of arousal between sandalwood and peppermint were significant, $t(95.07) = -8.93$, $p < .01$. Overall, participants perceived colour and scent in the way it was intended by the researcher.

The aforementioned questions were also used to check if the answers match the results of both pre-tests. As mentioned before, the low-arousing colour (blue) needed to be both pleasant and low arousing and the high-arousing colour (red) needed to be pleasant and high arousing. Similar to the results of the colour pre-test, it was the case in this field experiment. Referring to the scent pre-test, the low-arousing scent (sandalwood) needed to be pleasant and low arousing and the high-arousing scent (peppermint) needed to be pleasant and high arousing. Similar to the results of the scent pre-test, it was the case in this field experiment.

4.4 Effects of colour and scent

4.4.1 Main effects colour and scent

Table 4.3 gives an overview of the mean scores and standard deviations of the dependent variables per condition. First, the influence of colour and scent on cognitive performance is examined, then the influence of both environmental features on mood.

In order to test H1, a univariate analysis of variance (ANOVA) was conducted. The ANOVA results in table 4.4 show a significant main effect for colour on the 'EMT words' ($F(1,121) = 5.98, p < .05$). Figure 4.1 shows that scores on 'EMT words' were significantly lower in blue conditions ($M = 5.67, SD = 3.49$) compared to red conditions ($M = 7.31, SD = 3.90$), $t(119.25) = -2.45, p < .05$.

The ANOVA results also show a significant main effect for colour on the 'IQ test' ($F(1,121) = 4.09, p < .05$).

Figure 4.2 shows that scores on the 'IQ test' were significantly higher in blue conditions ($M = 8.42, SD = 1.36$) compared to red conditions ($M = 7.97, SD = 1.09$), $t(112.88) = 2.01, p < .05$. It was checked if there were differences in educational level of participants between both colours. Educational level may explain differences in 'IQ test' scores between both conditions. However, no differences were found ($Fisher's\ Exact\ Test = 2.43, ns$).

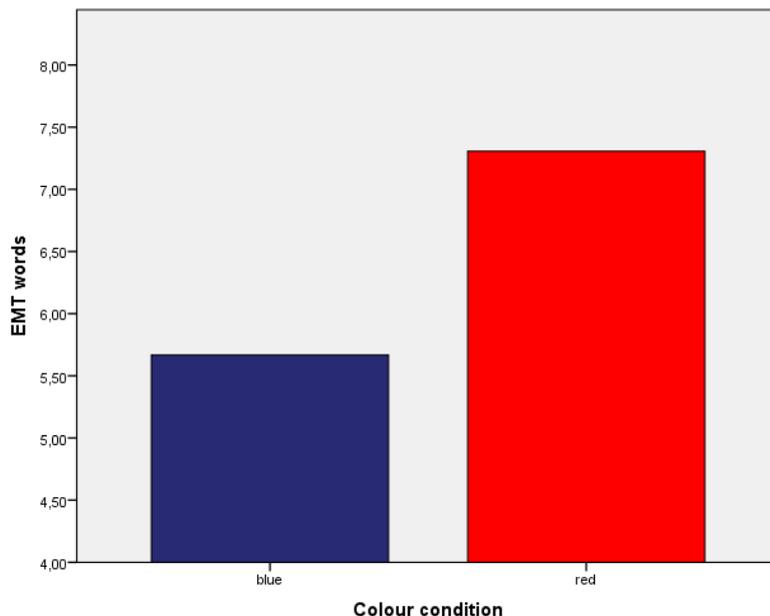


Figure 4.1 Score on EMT words per colour condition

Table 4.3 Means and standard deviations colour and scent per dependent variable

	Main effect colour		Main effect scent		Arousal congruence			Arousal incongruence		
	blue	red	sandalwood	Peppermint	blue/sw	red/pm	total	blue/pm	red/sw	total
TMT numbers	67.77 (18.07)	67.71 (14.58)	67.66 (17.66)	67.82 (14.96)	67.33 (20.22)	67.43 (14.14)	67.38 (17.30)	68.20 (15.97)	67.97 (15.20)	68.08 (15.45)
EMT words	5.67 (3.49)	7.31 (3.90)	6.58 (4.13)	6.42 (3.41)	5.33 (3.59)	6.83 (3.42)	6.08 (3.55)	6.00 (3.41)	7.75 (4.32)	6.90 (3.97)
EMT images	14.62 (4.53)	15.13 (3.95)	14.52 (4.55)	15.25 (3.88)	14.03 (4.60)	15.30 (3.29)	14.67 (4.02)	15.20 (4.45)	14.97 (4.53)	15.08 (4.46)
IQ test	8.42 (1.36)	7.97 (1.09)	8.27 (1.35)	8.10 (1.13)	8.80 (1.30)	8.17 (.91)	8.48 (1.16)	8.03 (1.33)	7.78 (1.21)	7.90 (1.26)
Pleasure	5.21 (.79)	5.03 (.87)	5.17 (.90)	5.07 (.77)	5.34 (.83)	5.06 (.81)	5.20 (.83)	5.08 (1.33)	5.01 (.94)	5.04 (.84)
Arousal	3.72 (.83)	4.49 (.93)	3.89 (.92)	4.34 (.95)	3.51 (.77)	4.75 (.89)	4.13 (1.04)	3.93 (.75)	4.24 (.91)	4.09 (.88)
Dominance	4.30 (.77)	4.06 (.81)	4.20 (.83)	4.16 (.77)	4.38 (.80)	4.10 (.80)	4.24 (.81)	4.22 (.74)	4.03 (.82)	4.12 (.78)

Table 4.4 Analysis of variance colour and scent per depend variable

	Main effect Colour		Main effect scent		Arousal (in)congruence	
	F	<i>p</i>	F	<i>p</i>	F	<i>p</i>
TMT numbers	<1	<i>ns</i>	<1	<i>ns</i>	<1	<i>ns</i>
EMT words	5.98	<.05	<1	<i>ns</i>	1.44	<i>ns</i>
EMT images	<1	<i>ns</i>	<1	<i>ns</i>	<1	<i>ns</i>
IQ test	4.09	<.05	<1	<i>ns</i>	6.98	<.01
Pleasure	1.36	<i>ns</i>	<1	<i>ns</i>	1.12	<i>ns</i>
Arousal	23.45	<.01	7.11	<.01	<1	<i>ns</i>
Dominance	2.64	<i>ns</i>	<1	<i>ns</i>	<1	<i>ns</i>

As mentioned above, also the effects of colour and scent on mood were studied. The ANOVA results show significant main effects for colour on arousal ($F(1,121) = 23.45, p < .01$). Figure 4.3 shows that participants experienced significantly less arousal in blue conditions ($M = 3.72, SD = 0.83$) compared to red conditions ($M = 4.49, SD = 0.93$), $t(119.13) = -4.85, p < .01$. These results are in line with the results of the manipulation check.

There also was found one main effect for scent on arousal ($F(1,121) = 7.11, p < .01$). Figure 4.4 shows that participants experienced significantly less arousal in the sandalwood conditions ($M = 3.89, SD = 0.92$) compared to the peppermint conditions ($M = 4.34, SD = 0.95$), $t(119.38) = -2.66, p < .01$. These results are also in line with the results of the manipulation check.

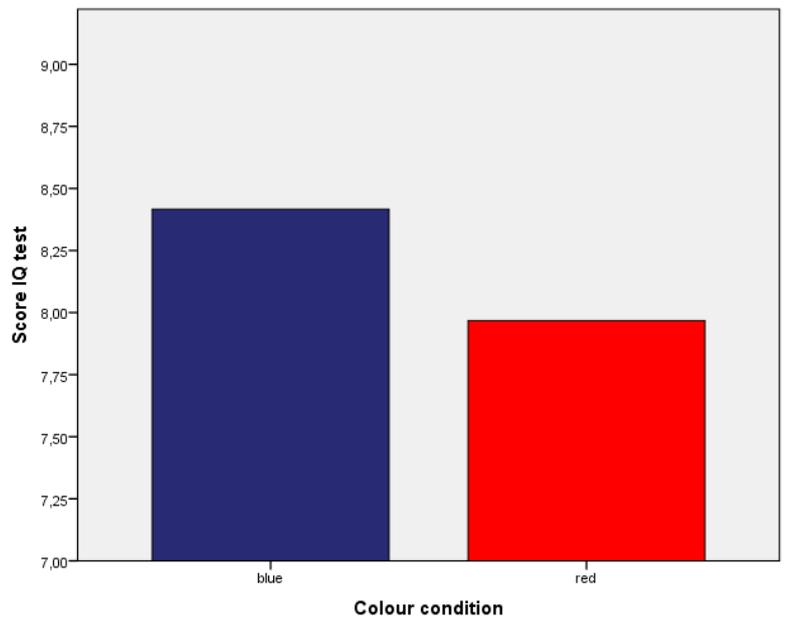


Figure 4.2 Score on IQ test per colour condition

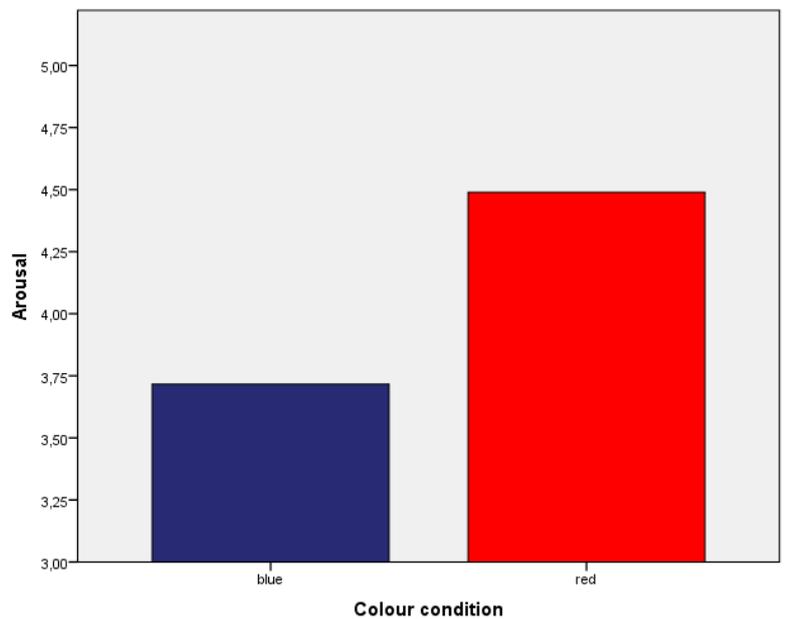


Figure 4.3 Arousal per colour condition

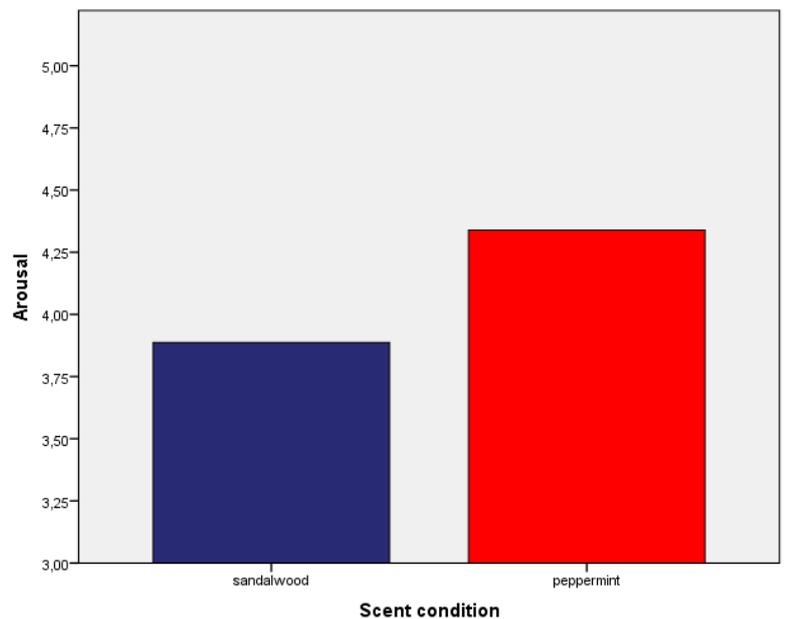


Figure 4.4 Arousal per scent condition

4.4.2 Effects in congruent conditions

In order to test H3, another univariate ANOVA was conducted. It tested possible differences in influence of congruent (blue-sandalwood and red-peppermint) and incongruent conditions (blue-peppermint and red-sandalwood) on the dependent variables.

The ANOVA results in table 4.4 show an effect of congruence on the 'IQ test' ($F(1,121) = 6.98, p < .01$). Comparisons show that scores on the 'IQ test' were significantly higher in congruent conditions ($M = 8.48, SD = 1.16$) compared to incongruent conditions ($M = 7.90, SD = 1.26$), $t(119.64) = 2.65, p < .01$. Hereby, it was also checked if there were differences in educational level of participants in congruent and incongruent conditions. However, no differences were found (*Fisher's Exact Test* = 7.05, *ns*).

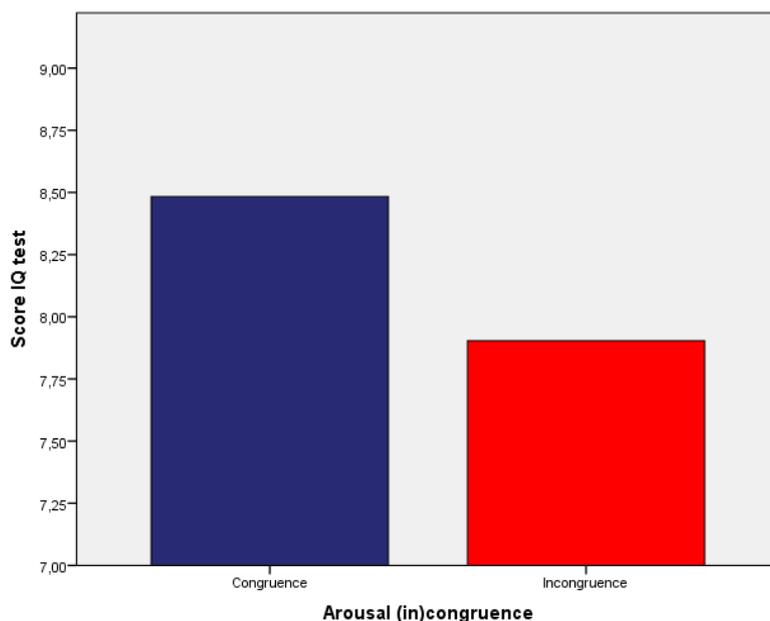


Figure 4.5 Score on IQ test based on arousal (in)congruence

4.5 Mediating effects of arousal on cognitive performance

In order to test H4, the mediating effect of arousal on cognitive performance was checked with the help of a research procedure suggested by Baron and Kenny (1986). To determine if there was a mediation effect of arousal on cognitive performance, four criteria must be met:

- The independent variable must affect the dependent variable(s);
- The independent variable must affect the mediator;
- The mediator must affect the dependent variable(s);
- The significant influence of the independent variable on the dependent variable(s) weakens in the presence of the mediator.

Table 4.5 Mediation analysis arousal

	Independent variables				Expected mediator	
	colour		scent		arousal	
	β	p	β	p	β	p
TMT numbers	-.06	<i>ns</i>	.16	<i>ns</i>	-.22	<i>ns</i>
EMT words	1.64	.02	-.16	<i>ns</i>	.10	<i>ns</i>
EMT images	.51	<i>ns</i>	.73	<i>ns</i>	.48	<i>ns</i>
IQ test	-.45	.05	-.17	<i>ns</i>	-.04	<i>ns</i>

Table 4.5 shows the results of the mediation analysis and indicates that the independent variable colour had a significant effect on the dependent variables, 'EMT words' ($\beta = 1.64$, $p < .05$) and 'IQ test' ($\beta = -0.45$, $p < .05$). Colour also significantly influenced the expected mediator arousal ($\beta = 0.21$, $p < .01$). However, arousal did not affect any of the dependent variables that represented cognitive performance. So, with the failure to meet the third and fourth criterion of Baron and Kenny (1986), it can be assumed that the influence of colour on the 'Ebbinghaus Memory Test words' and the 'IQ test' was not mediated by arousal.

Results in table 4.5 indicate that the independent variable scent had no significant effect on the dependent variables that represent cognitive performance. However, scent significantly influenced the expected mediator arousal ($\beta = 0.12$, $p < 0.01$). As mentioned earlier, arousal did not affect any of the dependent variables that represented cognitive performance. So, with the failure to meet the first, third and fourth criterion of Baron and Kenny (1986), it can be assumed that the influence of scent on cognitive performance was not mediated by arousal.

4.6 Moderating effects

4.6.1 Moderating effects of sensation seeking and its subscales

In order to test H5, to find out if sensation seeking was moderating the effects of colour and scent on mood and cognitive performance, an ANOVA was conducted. First, sensation seeking (SS) was examined as one construct, then thrill and adventure seeking (TAS), disinhibition (DIS) and boredom susceptibility (BS) were tested as individual moderators. Because of low internal consistency of experience seeking (ES) (Cronbach's α : .564), this construct was only used as a part of construct SS.

No moderating effects were found for SS, TAS, DIS and BS on the influence of colour and/or scent on the dependent variables: 'TMT', 'EMT words', 'EMT images', 'IQ test', pleasure and dominance. Disinhibition moderated the effects of scent on mood in terms of arousal.

A moderating effect of disinhibition was found on the influence of scent on arousal ($F(1,121) = 4.05, p < .05$). Figure 4.6 shows the moderating effect. For participants with high scores on DIS, peppermint ($M = 4.56, SD = .89$) increased arousal compared to sandalwood ($M = 3.86, SD = .99$), $t(46.82) = -2.69, p < .05$. For participants with low scores on DIS, no effects were found.

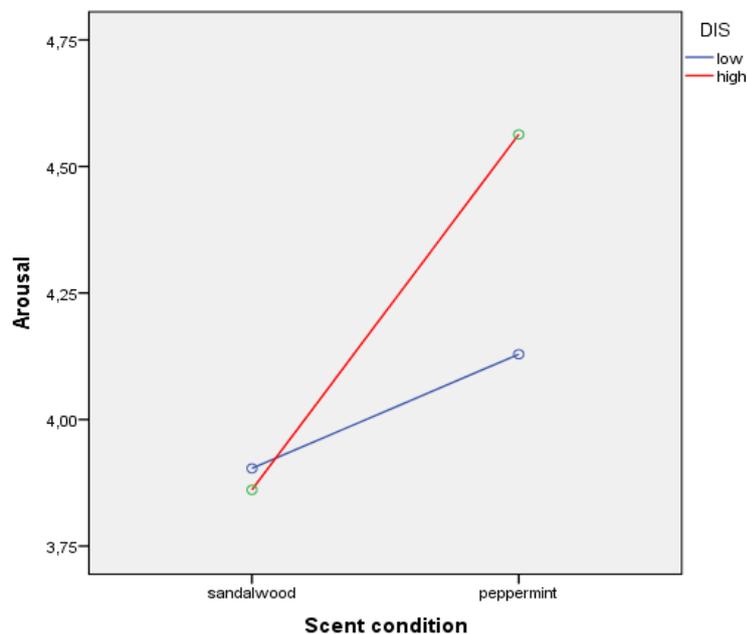


Figure 4.6 Moderating effect of DIS on the influence of scent on arousal

4.6.2 Moderating effects of sensation seeking and its subscales in congruent conditions

In order to test H6, to find out if SS, TAS, DIS and BS were moderating the effects of combined application of colour and scent on mood and cognitive performance, differences in influence of congruent and incongruent conditions on the dependent variables were examined.

There was found one moderating effect of thrill and adventure seeking on the influence of arousal congruence on pleasure ($F(1,121) = 5.48, p < .05$). Figure 4.7 shows the moderating effect. For participants with low scores on TAS, arousal congruence ($M = 5.23, SD = .74$) increased pleasure compared to arousal incongruence ($M = 4.77, SD = .91$), $t(59.84) = 2.23, p < .05$. For participants with high scores on TAS, no effects were found.

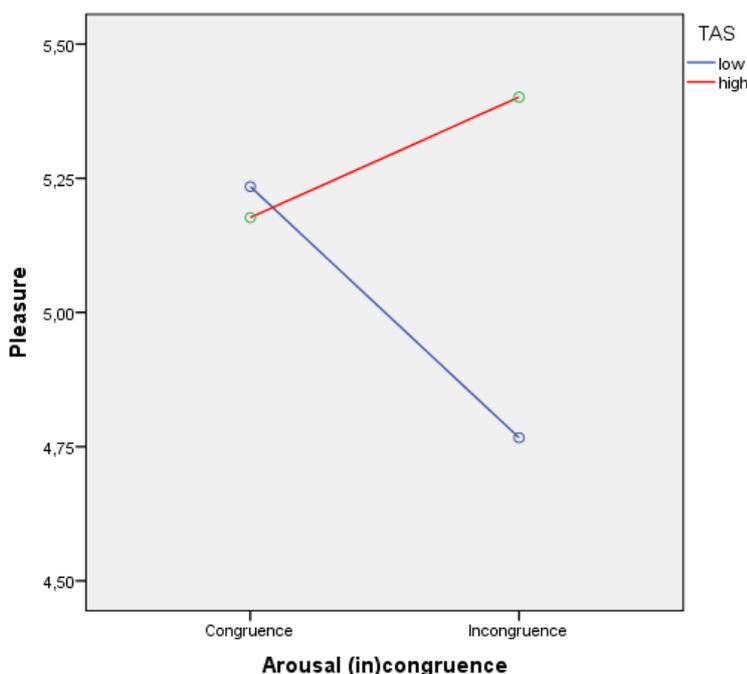


Figure 4.7 Moderating effect of TAS on the influence of arousal (in)congruence on pleasure

4.6.3 Moderating effects of gender, age and education

In order to test H7, to find out if gender, age and education were moderating the effects of colour and scent on mood and cognitive performance, a univariate ANOVA was conducted. First, it was examined if the demographics moderated the effects of colour and scent on cognitive performance, then if these were moderating the effects of colour and scent on mood.

A moderating effect of education was found on the influence of colour on the 'IQ test' score ($F(1,121) = 3.30, p < .05$). Figure 4.8 shows the moderating effect. Participants with a high level of education scored higher on the 'IQ test' in the blue meeting room ($M = 8.78, SD = 1.04$) compared to the red meeting room ($M = 7.96, SD = .88$), $t(42.67) = 2.91, p < .01$. For participants with low or medium education levels, no effects were found.

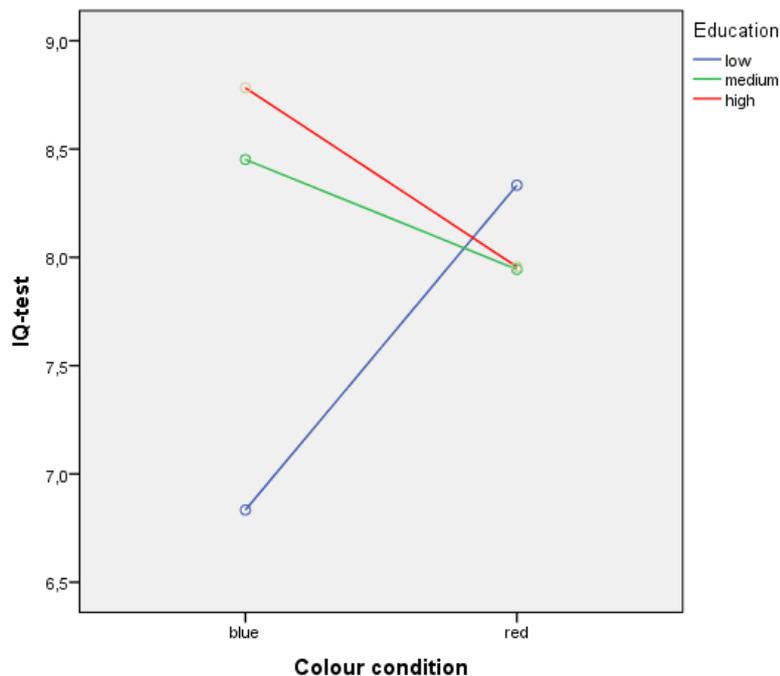


Figure 4.8 Moderating effect of education on the influence of colour on score IQ test

Another moderating effect was found. Education moderated the influence of scent on 'EMT words' ($F(1,121) = 4.00, p < .05$). Figure 4.9 shows the moderating effect. For participants with a high level of education, peppermint ($M = 6.78, SD = 3.07$) increased the scores on 'EMT words' compared to sandalwood ($M = 4.52, SD = 3.60$), $t(42.93) = -2.29, p < .05$. For participants with low or medium education levels, no effects were found. Thereby, the number of participants with a low education level was too small to get reliable results.

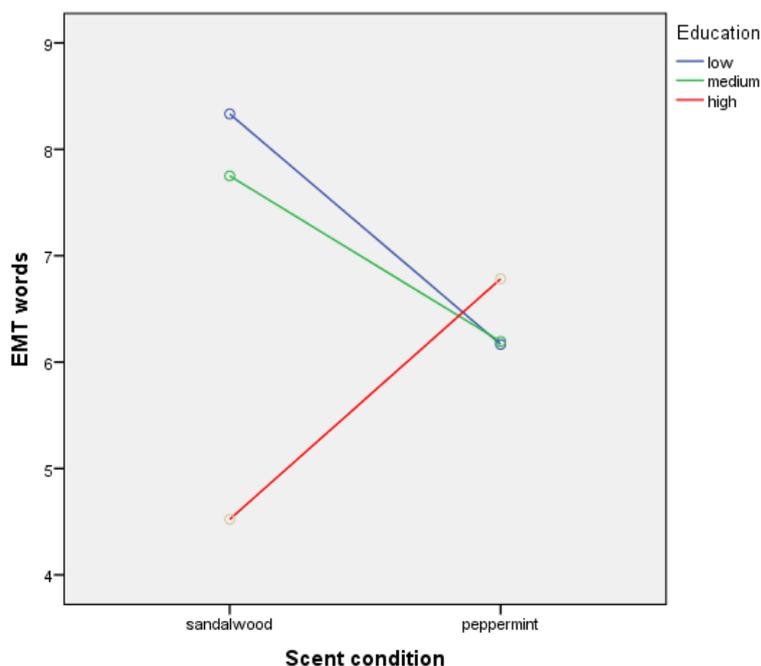


Figure 4.9 Moderating effect of education on the influence of scent on EMT words

There was also found a moderating effect of gender on the influence of scent on 'EMT images' ($F(1,121) = 12.22, p < .01$). Figure 4.10 shows the moderating effect. Female participants scored significantly lower on 'EMT images' in the sandalwood condition ($M = 13.55, SD = 3.65$) compared to the peppermint condition ($M = 17.30, SD = 4.13$), $t(46.67) = -3.37, p < .01$. For males, no effects were found.

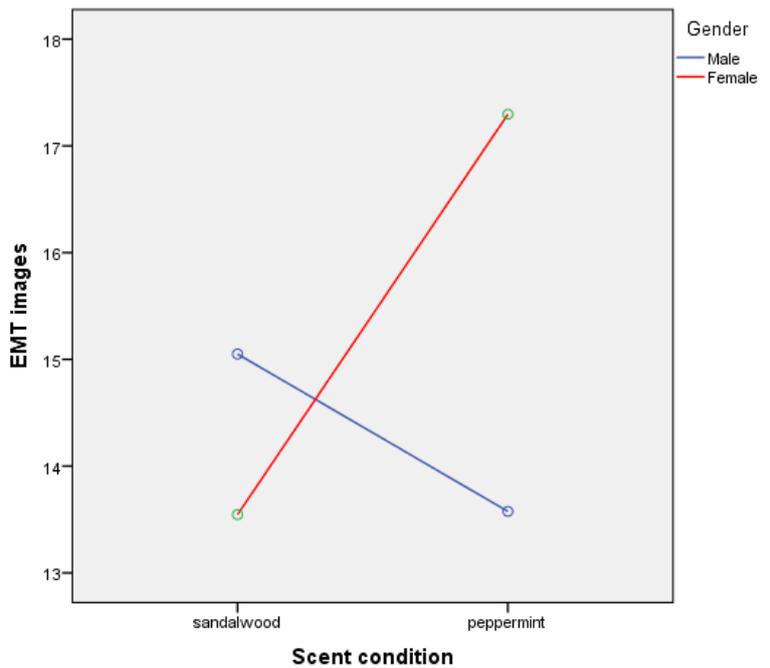


Figure 4.10 Moderating effect of gender on the influence of scent on EMT images

As mentioned above, also the moderating effects of gender, age and education on the influence of colour and scent on mood were studied. One moderating effect was found. Age moderated the influence of scent on arousal ($F(1,121) = 8.91, p < .01$). Figure 4.11 shows the moderating effect. Young participants experienced more arousal in the peppermint condition ($M = 4.52, SD = .88$) compared to the sandalwood condition ($M = 3.76, SD = .80$), $t(85.20) = -4.20, p < .01$. For older participants, no effects were found.

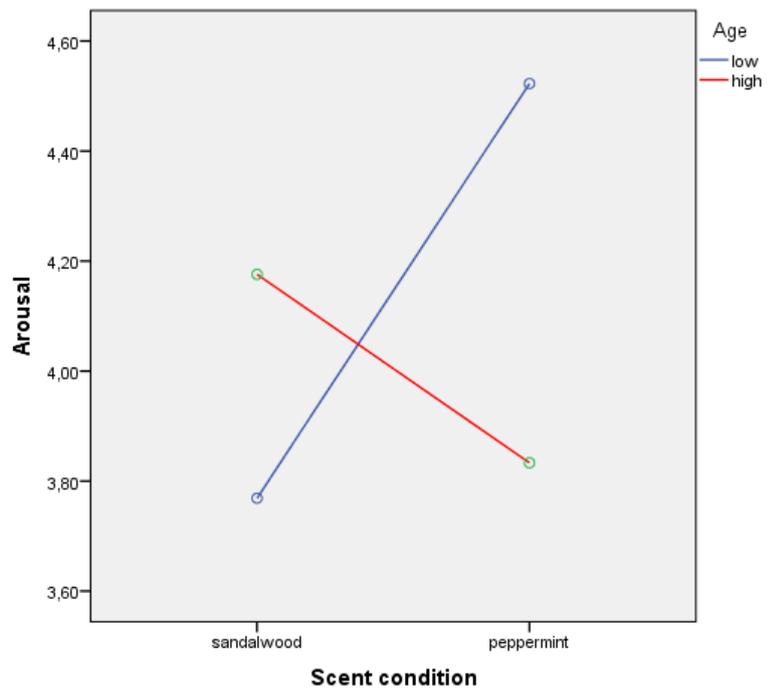


Figure 4.11 Moderating effect of age on the influence of scent on arousal

4.6.4 Moderating effects of gender, age and education in congruent conditions

In order to test H8, to find out if gender, age and education were moderating the effects of combined application of colour and scent on mood and cognitive performance, differences in influence of congruent and incongruent conditions on the dependent variables were examined.

There was found a moderating effect of education on the influence of arousal congruence on 'IQ test' score ($F(1,121) = 5.15, p < .01$). Figure 4.12 shows the moderating effect. For participants with a medium education level, arousal congruence ($M = 8.73, SD = .98$) increased the score on the 'IQ test' compared to arousal incongruence ($M = 7.73, SD = 1.31$), $t(64.67) = 3.59, p < .01$. For participants with low or high education levels, no effects were found. Thereby, the number of participants with a low education level was too small to get reliable results.

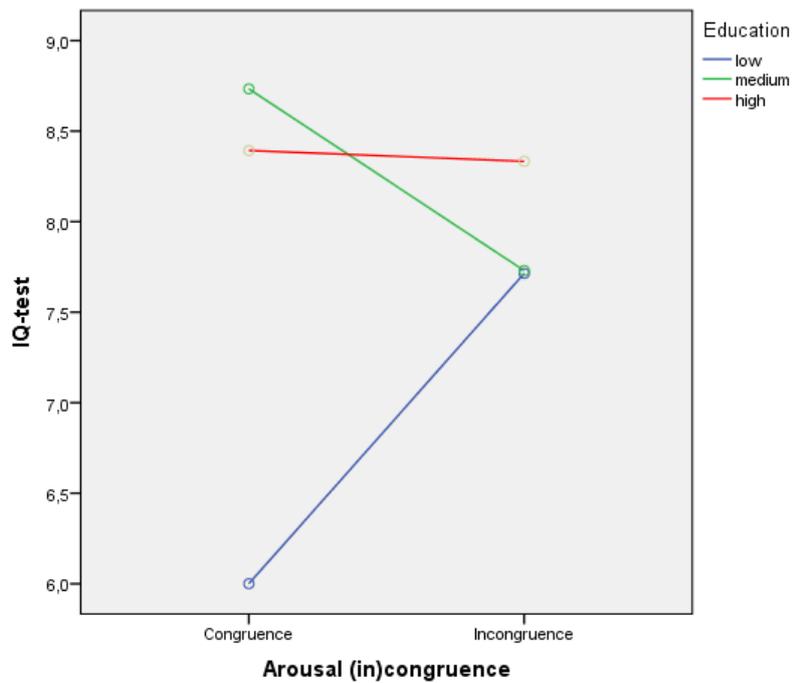


Figure 4.12 Moderating effect of education on the influence of arousal (in)congruence on score IQ test

One moderating effect was found for mood. Gender moderated the influence of arousal congruence on pleasure ($F(1,121) = 5.00, p < .05$). Figure 4.13 shows the moderating effect. Female participants experienced more pleasure in congruent conditions ($M = 5.31, SD = .81$) compared to incongruent conditions ($M = 4.74, SD = .78$), $t(46.99) = 2.51, p < .05$. No effects were found for male participants.

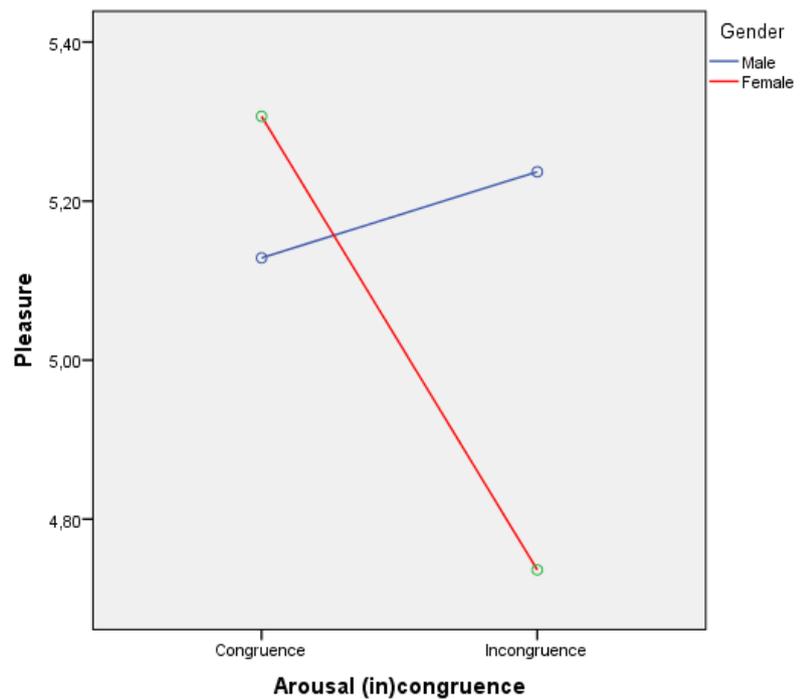


Figure 4.13 Moderating effect of gender on the influence of arousal (in)congruence on pleasure

5. Discussion

In this chapter, the results obtained in chapter 4 will be used to test the hypotheses in order to formulate a thorough answer on the main research question in chapter 6 'Conclusions'. Further, also the limitations of the research project and suggestions for future research will be specified.

5.1 Returning to the hypotheses

The previously described results partly confirm H1a and H1b: *The use of cool colours, compared to warm colours, leads to improved mood (H1a) and enhanced cognitive performance (H1b) of individuals in meeting rooms.* Participants experienced less arousal in blue compared to red meeting rooms. The experienced degree of arousal in both meeting rooms is consistent with findings of Wexner (1954) and Valdez and Mehrabian (1994) which found that there is a relationship between colour wavelength and level of arousal. According to Wexner (1954), cool colours are associated with calmness and serenity, effects of low arousal. In contrast, warm colours are associated with stressfulness and excitement, effects of high arousal.

Next, scores on the 'IQ test' were higher in blue meeting rooms than in red meeting rooms. Higher scores on the 'IQ test' in cool conditions can be explained by research of Stone (2003), which found that people performed better in blue environments compared to red environments in case of high demanding tasks. This finding is also consistent with research of Van Hagen (2011). He suggested to use cool colours in situations where people experience mental pressure. Nevertheless, participants scored higher on 'EMT words' in red conditions compared to blue conditions. This finding can be explained by Mehta and Zhu (2009). These researchers stated that warm colours enhanced cognitive performance on detail-oriented tasks. Due to the fact that 'EMT words' consisted of twelve fictional three-letter words which participants had to remember, it can be seen as a detail-oriented task.

Results partly confirm H2a and did not confirm H2b: *The use of relaxing scents, compared to stimulating scents, leads to improved mood (H2a) and enhanced cognitive performance (H2b) of individuals in meeting rooms.* Participants experienced less arousal in the sandalwood conditions compared to the peppermint conditions. These findings are consistent with findings of Ross (2010) and Raudenbosch et al. (2009). Ross (2010) defined sandalwood as a low-arousing, relaxing

scent. Raudenbosch et al. (2009) found that peppermint increased the alertness of participants during a driving task, so it can be interpreted as a high-arousing, stimulating scent. Both scents did not differ in influence on cognitive performance.

Results did not confirm H3a and partly confirm H3b: *Congruence between colour and scent (high/high and low/low arousing conditions) leads to improved mood (H3a) and enhanced cognitive performance (H3b) of individuals in meeting rooms compared to incongruence between colour and scent (high/low and low/high arousing conditions)*. Scores on pleasure, arousal and dominance were not different in congruent (blue-sandalwood and red-peppermint) and incongruent (blue-peppermint and red-sandalwood) conditions. So, congruent en incongruent conditions did not differ in influence on mood. However, participants scored higher on the 'IQ test' in congruent conditions. This is consistent with the processing theory of Reber et al. (2004). The processing fluency theory assumes that congruence between environmental features leads to better processing which results in enhanced cognitive performance on the 'IQ test'.

H4 cannot be confirmed: *The level of arousal mediates the effects of colour and scent on cognitive performance of individuals in meeting rooms*. Due to the fact that arousal did not affect any of the dependent variables that represented cognitive performance, not all criteria of Baron and Kenny (1986) were met. So, it can be assumed that the influence of colour and scent on cognitive performance was not mediated by arousal.

The results partly confirm H5a and did not confirm H5b: *Sensation seeking moderates the effects of colour and scent on mood (H5a) and cognitive performance (H5b) of individuals in meeting rooms*. Disinhibition had a moderating effect on the influence of scent on arousal. Participants with high scores on disinhibition experienced more arousal in the peppermint conditions compared to the sandalwood conditions. This finding can be attributed to research of Roberti (2004) which revealed that high sensation seekers, including individuals high in disinhibition, are more open to external stimulation. Due to the fact that the nervous system of low sensation seekers blocks stimuli to protect against abundance, it is possible that persons low in disinhibition were not fully aware of the arousing aspects of both scents. The fact that peppermint was experienced as more arousing is consistent with aforementioned findings of Ross (2010) and Raudenbosch et al. (2009). Next, sensation seeking cannot be seen as a moderator on the

influence of colour and scent on cognitive performance because no moderating effects of sensation seeking, also in terms of thrill and adventure seeking, disinhibition and boredom susceptibility were found.

H6a can be partly confirmed and H6b cannot be confirmed: *Sensation seeking moderates the effects of combined application of colour and scent, based on arousal congruence, on mood (H6a) and cognitive performance (H6b) of individuals in meeting rooms.* Thrill and adventure seeking had a moderating effect on the combined influence of colour and scent, based on arousal congruence, on pleasure. Participants with low scores on thrill and adventure seeking experienced more pleasure in congruent conditions compared to incongruent conditions. This finding is consistent with a study of Mattila and Wirtz (2001), they found that participants experienced an increased positive affect when exposed to 'matching' environmental features. The results are also consistent with the idea of processing fluency (Reber et al., 2004). Based on the processing fluency theory, congruence between environmental features leads to better processing which may result in higher pleasure ratings. Given that this finding only applied to participants with low scores on thrill and adventure seeking may be caused by the preference for low-arousing situations of low sensation seekers, including persons low in thrill and adventure seeking (Zuckerman, 1994). Referring to the processing fluency theory of Reber et al. (2004) again, congruent situations are easier to process and do not lead to high arousing situations. According to Zuckerman (1994), high sensation seekers tend to have a preference towards complex, ambiguous and intense stimuli, all effects which do not arise as a result of arousal congruence between colour and scent. Sensation seeking cannot further be seen as a moderator on the combined influence of colour and scent, based on arousal congruence, on cognitive performance because no moderating effects of sensation seeking, also in terms of thrill and adventure seeking, disinhibition and boredom susceptibility were found.

The results partly confirm H7a and H7b: *Gender, age and education moderate the effects of colour and scent on mood (H7a) and cognitive performance (H7b) of individuals in meeting rooms.* Age has a moderating effect on the influence of scent on arousal. Young participants experienced more arousal in the peppermint condition. The fact that peppermint was experienced as more arousing than sandalwood is consistent with the aforementioned findings of Ross (2010) and

Raudenbosch et al. (2009). The differences in age may be explained by research of Wang et al. (2005). With the help of magnetic resonance imagery techniques they found that older individuals have the same areas of the olfactory cortex activated when exposed to lavender and mint, but they demonstrated lower activation volume and intensity in those areas, indicating weakened olfactory capacities. This suggests that an increased intensity of sandalwood and peppermint may have led to different results for older people. Next, age cannot be seen as a moderator on the influence of colour and scent on cognitive performance because no moderating effects of age were found.

Education had a moderating effect on the influence of colour and the influence of scent on cognitive performance. Participants with a high education level scored higher on the 'IQ test' in a blue meeting room than in a red one. Higher scores on the 'IQ test' in cool conditions can be explained, as with hypothesis 1, by research of Stone (2003), which found that people performed better in cool coloured environments compared to warm coloured environments in case of high demanding tasks. Participants with a high education level also scored higher on 'EMT words' in the peppermint compared to the sandalwood condition. The same goes for female participants, they scored higher on 'EMT images' in the peppermint compared to the sandalwood condition. These findings can be explained by a study of Moss et al. (2008). Moss et al. (2008) provided evidence that peppermint, a high arousing scent, enhanced memory. Thereby, findings of Raudenbosch et al. (2009) stated that peppermint positively affects motivation and alertness. Especially the latter, alertness, may contribute to better scores on memory tests. The gender differences are consistent with findings of Koelega (1994) who stated that females have more developed schemas with regard to olfactory cues and a heightened sensitivity to scents compared to males. However, it cannot yet be explained why the moderating effects only applied to people with a high education level and not to people with low or medium education levels. Gender and education cannot further be seen as moderators on the influence of colour and scent on mood because no moderating effects of gender and education were found.

The results partly confirm H8a and H8b: *Gender, age and education moderate the effects of combined application of colour and scent, based on arousal congruence, on mood (H8a) and cognitive performance (H8b) of individuals in meeting rooms.* Education had a moderating effect on the combined influence of colour and scent, based on arousal congruence, on cognitive

performance. Participants with a medium education level scored higher on the 'IQ test' in congruent conditions (blue-sandalwood and red-peppermint) compared to incongruent conditions (blue-peppermint and red-sandalwood). This finding can be explained by the processing fluency theory of Reber et al. (2004), congruence between environmental features may lead to better processing which results in enhanced cognitive performance on the 'IQ test'. However, it cannot yet be explained why the moderating effects only applied to people with a medium education level and not to people with low or high education levels. Thereby, education cannot be seen as a moderator on the combined influence of colour and scent, based on arousal congruence, on mood because no moderating effects of education were found.

A moderating effect of gender was found on the combined influence of colour and scent, based on arousal congruence, on pleasure. Female participants experienced more pleasure in congruent conditions compared to incongruent conditions. This finding is also consistent with the aforementioned findings of Mattila and Wirtz (2001) and the idea of processing fluency (Reber et al., 2004). The gender differences are in line with findings of Meyers-Levy and Maheswaran (1991) who stated that compared to males, females are more detail-oriented and therefore show a greater sensitivity to environmental features. Gender cannot further be seen as a moderator on the combined influence of colour and scent, based on arousal congruence, on cognitive performance because no moderating effects of gender were found.

5.2 General discussion

Use of cool colours in a meeting room, compared to warm colours, led to improved performance on a demanding cognitive task (IQ test). This finding can be explained by the fact that warm colours (high arousing) are seen as distracting (Bellizzi & Hite, 1992). Cool colours have less distracting properties and are therefore more useful in high demanding situations. Also research of Stone (2003) found that people performed better in cool coloured environments compared to warm coloured environments in case of high demanding tasks. Van Hagen (2011) endorsed this finding. He suggested using cool colours in situations where people experience mental pressure. It is found that, compared to people with low or medium education levels, individuals with a high education level scored better on a high demanding cognitive task in a blue meeting room than in red one.

However, on a more detail-oriented cognitive task (memory test with fictional words), performance of individuals improved in a red compared to a blue meeting room. This could be the result of the association of red with danger and mistakes, which activates avoidance behaviour, which in turn makes people more vigilant (Mehta & Zhu, 2009).

Compared to people with low and medium education levels, individuals with a high education level also showed better scores on a detail-oriented cognitive task in a meeting room with a stimulating scent than in a meeting room with a relaxing scent. The same applied to females, they also scored higher on a detail-oriented cognitive task in a meeting room with a stimulating scent compared to a meeting room with a relaxing scent. According to Koelega (1994), this can be declared by the fact that females have more developed schemas with regard to olfactory cues and a heightened sensitivity to scents. The stimulating effect of peppermint may be experienced more intensely by females and subsequently increased their motivation and alertness. As mentioned before, Moss et al. (2008) and Raudenbosch et al. (2009) found that peppermint enhanced memory.

Combined application of colour and scent based on arousal congruence resulted in enhanced performance on a high demanding cognitive task in congruent conditions (high/high and low/low arousing properties) compared to incongruent conditions (high/low and low/high arousing properties). Compared to people with high or low education levels, individuals with a medium education level scored better on a high demanding cognitive task in a meeting room with congruent colour-scent conditions compared to incongruent colour-scent conditions. Based on the processing fluency theory of Reber et al. (2004) these findings make sense, congruence between colour and scent leads to better and easier processing which results in enhanced performance on a high demanding task. Further research is needed to explain why the moderating effects of education in several cases only applied to people with specific education levels (or high or medium levels).

Use of cool colours in a meeting room, compared to warm colours, led to less feelings of arousal. In addition, use of relaxing scents (i.e. sandalwood), compared to stimulating scents (i.e. peppermint), also led to less feelings of arousal. These findings are consistent with existing literature related to the arousability of colour and scent (Ross, 2010; Raudenbosch et al., 2009; Valdez & Mehrabian, 1994; Wexner, 1954). Disinhibited people, individuals who are less inhibited

by social norms and expectations, experienced more arousal in a meeting room with a stimulating scent compared to one with a relaxing scent. According to Roberti (2004), this can be explained by the fact that high sensation seekers, including individuals high in disinhibition, are more open to external stimulation. Also young people, compared to older people, felt more aroused in a meeting room with a stimulating scent than in one with a relaxing scent. Wang et al. (2005) regard this as a result of lower activation volume and intensity in the olfactory cortex of older people, indicating weakened olfactory capacities.

According to the optimal arousal theory of Apter (2007), too low or too high stimulation may result in discomfort and negative feelings. Thereby, the reversal theory of Apter (2007) assumes that the state in which people are situated determines the required level of stimulation. On the one hand, people in the telic state are serious and focused (low arousal required). On the other hand, people in the paratelic state need stimulation and are light-hearted and spontaneous (high arousal required). So, which level of arousal is preferred to positively affect people's mood in meeting rooms is largely situation specific and depends on several factors.

Combined application of colour and scent based on arousal congruence (high/high and low/low arousing properties) resulted in more feelings of pleasure for individuals with low desire to get involved in physical activities with speed and danger. A reason why this only applied to this subgroup may be caused by the preference for low-arousing situations of low sensation seekers, including people low in thrill and adventure seeking (Zuckerman, 1994). The same applied to females, they also experienced more feelings of pleasure in congruent compared to incongruent colour-scent conditions. A finding which can be explained by Meyers-Levy and Maheswaran (1991) who found that females are more detail-oriented and therefore show a greater sensitivity to environmental features. In line with results of Mattila and Wirtz (2001), Michon and Chebat (2006) and Verstaen (2011), these findings show that 'matching' environmental features results in a positive affective response, namely more feelings of pleasure in meeting rooms for the aforementioned groups. Also based on the processing fluency theory of Reber et al. (2004) these findings make sense, congruence between colour and scent leads to better and easier processing which results in more feelings of pleasure.

5.3 Limitations and suggestions for future research

This study has several limitations. One of limitations is the lack of a control condition in which the (combined) application of colour and scent can be compared with the absence of these environmental features. Adding a control condition to future research projects may provide an answer to the question whether (combined) application of colour and scent in meeting rooms actually leads to improved mood and cognitive performance. This study also did not contain conditions with colour and scent separately. In every experimental condition, one of the four colour-scent conditions was applied. Adding separate colour and scent conditions to future research would make this limitation disappear.

In this study, only two types of environmental features were examined. The combination of other environmental features with colour and scent, such as lighting or temperature may provide further insights in people's mood and cognitive performance in meeting rooms. Next, only two varieties of colour and scent were tested. Future research should consider more varieties of colour and scent. Also, other dimensions of colour (i.e. brightness and saturation) and scent (i.e. intensity) should be examined. In addition, this study is also limited in studying the effects of congruence between colour and scent. Krishna, Elder and Caldara (2010) concluded that research into congruence should not be limited to just the arousal dimension, since congruence includes other dimensions as congruence between semantic associations of colour and scent.

Noteworthy is that in the scent pre-test, participants evaluated eight scents for approximately half a minute per scent. In the meeting room, participants often were confronted with the scent for a long period of time (+/- 30 minutes). After the study, some participants noted that the stimulating scent (peppermint) was annoying. An explanation might be that prolonged exposure to a (stimulating) scent can cause feelings of irritation. Although participants overall evaluated the scent positively, it is recommended to conduct a more extensive pre-test in future research and examine the effects of prolonged exposure to relaxing and stimulating scents.

As mentioned before, cognitive performance indicates abilities and skills from the psychological functional ranges of perception, attention, learning and retention, thinking, intelligence and psychomotor activity. In this study only attention, learning and retention and intelligence were tested. Thereby, short versions of the cognitive tests were used. For example, the

'IQ test' consisted of ten multiple-choice questions, one of each item of a regular IQ test. Normally, an IQ test consists of at least sixty questions. So, in order to test cognitive performance future research has to make use of more extended and validated cognitive tests.

In addition, the experiment was carried out in only one meeting room, which makes it difficult to generalize the aforementioned results. Future research in the (combined) application of colour and scent should take place in various meeting rooms. For example, data must be gathered in meeting rooms of different sizes and at different locations (i.e. office buildings). Subsequently, all data were collected on working and weekend days from 10:00 till 20:00, which can have an adverse effect in comparing the results. For example, people may score differently on the cognitive performance test on a weekend day compared to a busy working day. Future research should collect data in comparable time sessions (i.e. only at working days).

6. Conclusions and practical implications

This chapter gives an answer to the previously formulated research question. Then, some practical implications based on the results of this research project are given for use in companies and other institutions.

6.1 Answer to the research question

The research question was: *To what extent do colour and scent, also in combined application based on arousal congruence, affect people's mood and cognitive performance in meeting rooms?*

Results show that both colour and scent separately, as in combined application based on arousal congruence, affect people's mood and/or cognitive performance in meeting rooms.

Use of cool colours, compared to warm colours, led to improved performance on a demanding cognitive task in a meeting room. Next to the aforementioned finding, individuals with a high education level scored better on a high demanding cognitive task in a cool coloured meeting room than in a warm coloured one. However, on a more detail-oriented cognitive task, performance of individuals improved in a warm coloured compared to a cool coloured meeting room. Individuals with a high education level and females also performed better on a detail-oriented cognitive task in a meeting room with a stimulating scent than in a meeting room with a relaxing scent. Combined application of colour and scent based on arousal congruence resulted in enhanced performance on a high demanding cognitive task in congruent conditions compared to incongruent conditions. In addition, individuals with a medium education level scored better on a high demanding cognitive task in a meeting room with congruent colour-scent conditions compared to a meeting room with incongruent colour-scent conditions.

Use of cool colours, compared to warm colours, also led to less feelings of arousal in a meeting room. Use of relaxing scents compared to stimulating scents also led to less feelings of arousal. Next to the aforementioned findings, disinhibited people experienced more arousal in a meeting room with a stimulating scent compared to one with a relaxing scent. This also applied to young people, they felt more aroused in an environment with a stimulating scent than in one with a relaxing scent. Other mood dimensions, pleasure and dominance, did not differ between both colour conditions and both scent conditions. Combined application of colour and scent based on

arousal congruence resulted in more feelings of pleasure for individuals low in thrill and adventure seeking. The same applied to females, they also experienced more feelings of pleasure in a meeting room with congruent compared to incongruent colour-scent conditions. Arousal and dominance, two other dimensions of mood did not differ in both conditions.

6.2 Practical implications

As stated before, mood and cognitive performance are related to productivity, a key concept in companies and institutions. These organizations lay focus on making environments more comfortable and inviting to make sure that people can function at their optimum. Therefore, this research project examined the influence of two environmental features, colour and scent, also in combined application based on arousal congruence, on people's mood and cognitive performance in meeting rooms. Based on the results some suggestions about the (combined) application of colour and scent on mood and cognitive performance can be formulated.

In case organizations intend to make use of colour and scent separately in meeting rooms, it is necessary to provide insight in the activities that will take place in these meeting rooms. On the one hand, if activities are high demanding, for example thinking up new strategies or product-market combinations, it is recommended to use low-arousing environmental features as cool colours or relaxing scents. Low-arousing environmental features have less distracting properties and are therefore more useful in case of high demanding tasks. On the other hand, if activities are detail-oriented, for example contract negotiations with suppliers, it is advisable to use high-arousing environmental features as warm colours or stimulating scents. These environmental features will make individuals more vigilant. Related to mood, it is important to consider that too little or too high stimulation by environmental features in meeting rooms may result in feelings of discomfort. Application of a medium degree of arousal should prevent employees for example for bored feelings but also for feelings of stress.

When combining both environmental features, congruence between colour and scent will cause more feelings of pleasure among females in meeting rooms. Despite the fact that males do not experience more or less feelings of pleasure when both environmental features are matched, it is recommended to combine colour and scent based on arousal congruence. This combined

application also causes enhanced performance on high demanding activities for both males and females. So, when organizations intend to make use of both environmental features in meeting rooms, ensure congruence between colour and scent based on arousal. It is important that managers are aware of the fact that not all combinations between environmental features will lead to positive effects. Use of incongruence conditions will most likely not lead to favorable outcomes. Therefore, a careful selection must be made of which colours and scents should be applied. Manipulation with the help of environmental features in meeting rooms is an inexpensive technique that can affect mood and cognitive performance of employees. It may result in higher productivity which gives the organization the opportunity to flourish.

Looking at the practical applicability, it is advisable that organizations make use of a meeting room where colour and scent can be changed depending on the activities that take place in the meeting room. For example, with the help of LED lighting colour can easily be changed from cool (i.e. blue) to warm (i.e. red). The same goes for scent, with the help of a(n) (electric) scent diffuser, different scents can easily be spread in the meeting room. In case companies have several meeting rooms available, it is also possible to paint half of the meeting rooms in cool colours and the other half in warm colours. Dependent on the activities (and even the mood of employees), a suitable meeting room can be chosen. Thereby, an appropriate (matching) scent can be spread with the help of a(n) (electric) scent diffuser.

Besides application in meeting rooms of companies or hotels, (combined) application of colour and scent may also provide guidance in educational institutions and factories. The environmental features, separately or in combined application based on arousal congruence, might help students to perform better during classes or examinations in classrooms. It may also increase the productivity of manufacturing teams in factories.

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Appendices

Appendix A: Materials colour pre-test

Appendix B: Questionnaire colour pre-test

Appendix C: ANOVAs colour pre-test

Appendix D: Materials scent pre-test

Appendix E: Questionnaire scent pre-test

Appendix F: ANOVAs scent pre-test

Appendix G: Four colour-scent conditions

Appendix H: Ishihara's test

Appendix I: Cognitive performance test and questionnaire

Appendix A: Materials colour pre-test



Orange



Yellow



Green



Brown



Violet



Silver grey



Blue



Grey



Red



Pink

Appendix B: Questionnaire colour pre-test

UNIVERSITEIT TWENTE.

Dear participant,

My name is Bart Hulshof and I am studying Communication Science with the specialization Marketing Communication at the University of Twente. For graduation, I am writing my Master Thesis about the influence of color and scent on people in meeting rooms. I really appreciate that you would make some time to help me with this research. On a computer screen, ten meeting rooms will be shown in different colors (color A-J). At every meeting room, try to specify your feelings on a 7-point scale. Make sure that you'll only specify your feelings regarding the color of the meeting room. Completing the questionnaire will not take longer than 10 minutes.

Thanks for your help.

Bart Hulshof

Part 1:

What is your gender?

Male

Female

How old are you?

..... years

Appendix C: ANOVAs colour pre-test

To compare the effects of the colours on pleasure, a repeated measures ANOVA was carried out. A significant effect of colour type was found on pleasure ($F(9,16) = 8.75, p < .01$). Blue ($M = 5.09, SD = .73$) and orange ($M = 4.61, SD = .95$), $t(24) = 2.18, p < .05$; blue and brown ($M = 4.25, SD = .62$), $t(24) = 4.45, p < .01$; blue and violet ($M = 4.29, SD = .69$), $t(24) = 4.75, p < .01$ and blue and pink ($M = 4.39, SD = .98$), $t(24) = 2.92, p < .05$, differed significantly in scores on this construct. Pair wise comparisons of yellow ($M = 4.75, SD = .83$) and brown $t(24) = 3.26, p < .05$ and yellow and violet, $t(24) = 2.38, p < .05$ also indicated a significant difference in pleasure. Also significant differences were found in the scores on pleasure between green ($M = 4.73, SD = .84$) and brown, $t(24) = 2.84, p < .05$ and green and violet, $t(24) = 2.41, p < .05$. Silver grey ($M = 3.36, SD = .81$) and grey ($M = 3.73, SD = .98$) scored statistically lower on pleasure than all other colours. Because the main study only needs colours high on pleasure, significant differences between these colours and the other colours were not further presented.

To compare the effects of the colours on arousal, a repeated measures ANOVA was carried out. A significant effect of colour type was found on arousal ($F(9,16) = 55.55, p < .01$). Orange ($M = 4.33, SD = .60$) and yellow ($M = 3.87, SD = .42$), $t(24) = 3.47, p < .05$; orange and green ($M = 2.75, SD = .58$), $t(24) = 10.75, p < .01$; orange and brown ($M = 3.61, SD = .64$), $t(24) = 4.61, p < .01$; orange and violet ($M = 3.05, SD = .59$), $t(24) = 8.50, p < .01$; orange and blue ($M = 2.57, SD = .48$), $t(24) = 9.84, p < .01$ and orange and red ($M = 5.17, SD = .51$), $t(24) = -5.32, p < .01$, differed significantly in scores on arousal. Pair wise comparisons of yellow and green, $t(24) = 10.52, p < .01$; yellow and violet $t(24) = 6.03, p < .01$; yellow and blue, $t(24) = 9.38, p < .01$; yellow and red, $t(24) = -8.72, p < .01$ and yellow and pink ($M = 4.43, SD = .67$), $t(24) = -3.52, p < .05$, also indicated a significant difference in scores on arousal. Furthermore, significant differences were found in the scores on arousal between green and brown, $t(24) = -5.76, p < .01$; green and red, $t(24) = -14.39, p < .01$ and green and pink, $t(24) = -9.44, p < .01$. Also, pair wise comparisons between brown and violet, $t(24) = 2.96, p < .05$; brown and blue, $t(24) = 6.14, p < .01$; brown and red, $t(24) = -11.69, p < .01$ and brown and pink, $t(24) = -4.64, p < .01$, indicated a significant

difference in scores on arousal. Additionally, significant differences were found in the scores of arousal between violet and blue, $t(24) = 2.85, p < .05$; violet and red, $t(24) = -13.78, p < .01$ and violet and pink, $t(24) = -8.59, p < .01$. Finally, blue and red, $t(24) = -19.60, p < .01$; blue and pink, $t(24) = -9.64, p < .01$; red and pink, $t(24) = 4.73, p < .01$, also differed significantly in scores on arousal. Since silver grey and grey scored significantly lower on pleasure than the other colors, these are also not included in the results of arousal.

Appendix D: Materials scent pre-test



A: sandalwood, B: vanilla, C: peppermint, D: lemon, E: lavender, F: green apple, G: eucalyptus and H: rose. The bamboo sticks in the front were used to diffuse the scents.



One of the eight scents (sandalwood) on cottons in a sealable cup.

Appendix E: Questionnaire scent pre-test

UNIVERSITEIT TWENTE.

Dear participant,

My name is Bart Hulshof and I am studying Communication Science with the specialization Marketing Communication at the University of Twente. For graduation, I am writing my Master Thesis about the influence of color and scent on people in meeting rooms. I really appreciate that you would make some time to help me with this research. You will randomly smell eight scents (scent A-H) on cottons in sealable cups. After you have opened the cover, hold the cup 10 to 15 centimeters from your nose and make five 'wave gestures' towards your nose. This method will give you a good impression of the respective scent. Try to specify your feelings on a 7-point scale after you have smelled the scent. After each scent you should smell at your own skin to 'neutralize' your nose. Make sure that you'll only specify your feelings regarding the scent. Completing the questionnaire will not take longer than 10 minutes.

Thanks for your help.

Bart Hulshof

Part 1:

What is your gender?

- Male
- Female

How old are you?

..... years

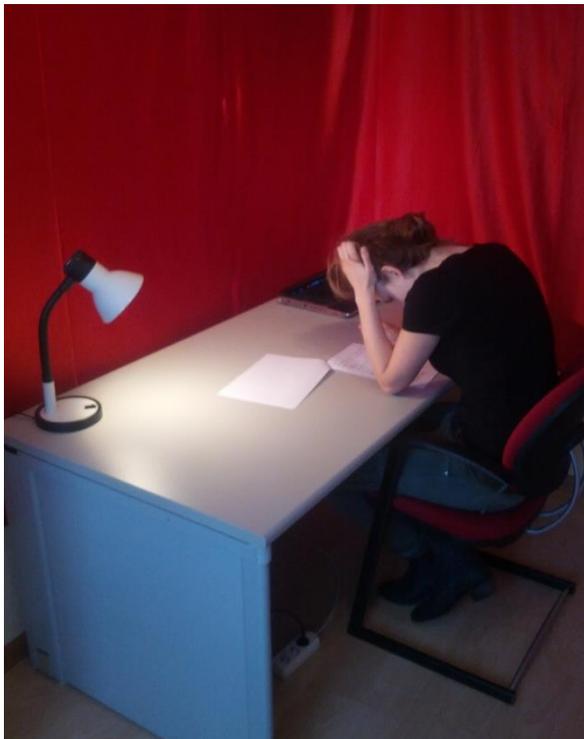
Appendix F: ANOVAs scent pre-test

To compare the effects of the scents on pleasure, a repeated measures ANOVA was carried out. A significant effect of scent type was found on pleasure ($F(7,18) = 9.48, p < .01$). Sandalwood ($M = 5.20, SD = .70$) and vanilla ($M = 4.19, SD = 1.02$), $t(24) = 3.71, p < .05$; sandalwood and peppermint ($M = 4.34, SD = .91$), $t(24) = 3.64, p < .05$; sandalwood and lemon ($M = 4.16, SD = .99$), $t(24) = 4.44, p < .01$; sandalwood and eucalyptus ($M = 4.09, SD = .94$), $t(24) = 5.59, p < .01$; sandalwood and lavender ($M = 4.45, SD = .92$), $t(24) = 3.15, p < .05$; sandalwood and green apple ($M = 4.37, SD = .94$), $t(24) = 3.27, p < .05$ and sandalwood and rose ($M = 3.96, SD = .75$), $t(24) = 7.46, p < .01$ differed significantly in scores on pleasure. Also significant differences were found on pleasure between lavender and rose, $t(24) = 2.08, p < .05$.

Another repeated measures ANOVA was carried out to compare the effects of the scents on arousal. Also a significant effect of scent type was found on arousal ($F(7,18) = 88.23, p < .01$). Sandalwood ($M = 2.29, SD = .43$) and vanilla ($M = 3.29, SD = .45$), $t(24) = -7.48, p < .01$; sandalwood and peppermint ($M = 5.31, SD = .56$), $t(24) = -19.42, p < .01$; sandalwood and lemon ($M = 4.81, SD = .62$), $t(24) = -18.52, p < .01$; sandalwood and eucalyptus ($M = 4.32, SD = .57$), $t(24) = -16.17, p < .01$; sandalwood and lavender ($M = 2.59, SD = .57$), $t(24) = -2.47, p < .05$ and sandalwood and green apple ($M = 4.24, SD = .67$), $t(24) = -11.93, p < .01$, differed significantly in scores on arousal. Pair wise comparisons of vanilla and peppermint, $t(24) = -12.91, p < .01$; vanilla and lemon $t(24) = -8.71, p < .01$; vanilla and eucalyptus, $t(24) = -7.01, p < .01$; vanilla and lavender, $t(24) = 5.30, p < .01$; vanilla and green apple, $t(24) = -6.65, p < .01$ and vanilla and rose ($M = 2.47, SD = .52$), $t(24) = 5.63, p < .01$ also indicated a significant difference in scores on arousal. Furthermore, significant differences were found in the scores of arousal between peppermint and lemon, $t(24) = 2.82, p < .05$; peppermint and eucalyptus, $t(24) = 6.69, p < .01$; peppermint and lavender, $t(24) = 15.60, p < .01$; peppermint and green apple, $t(24) = 5.71, p < .01$ and peppermint and rose, $t(24) = 18.42, p < .01$. Also, pair wise comparisons between lemon and eucalyptus, $t(24) = 2.60, p < .05$; lemon and lavender, $t(24) = 12.54, p < .01$; lemon and green apple, $t(24) = 2.98, p < .05$; lemon and rose, $t(24) = 15.92, p < .01$; eucalyptus and lavender, $t(24)$

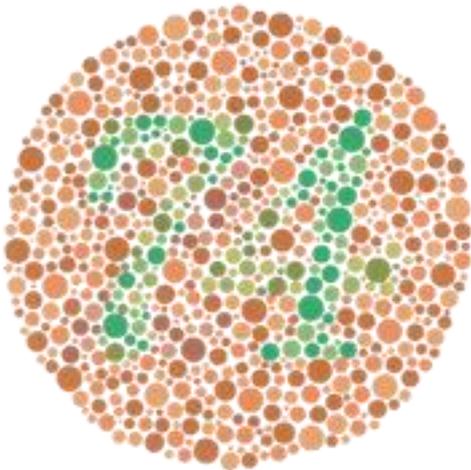
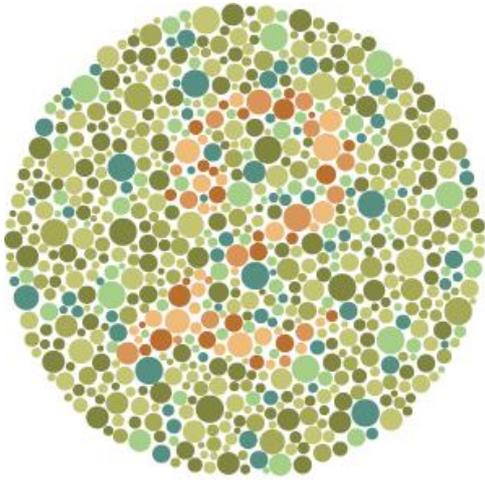
= 10.33, $p < .01$; eucalyptus and rose, $t(24) = 11.48$, $p < .01$; lavender and green apple, $t(24) = -11.21$, $p < .01$ and green apple and rose, $t(24) = 8.70$, $p < .01$ indicated a significant difference in scores on arousal.

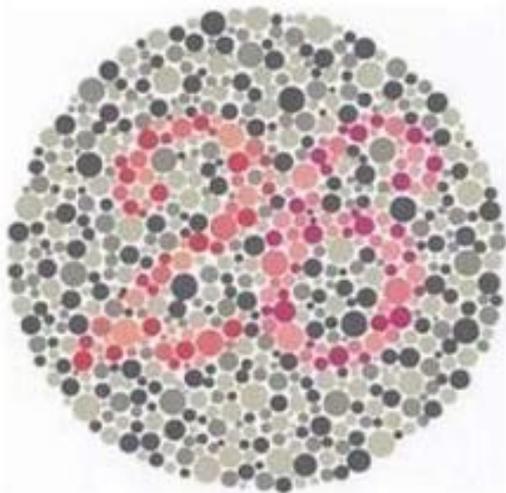
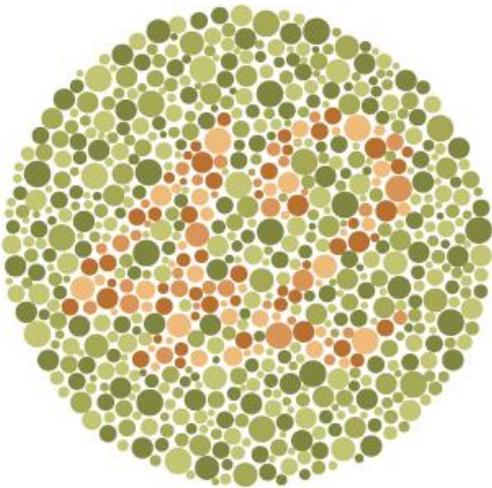
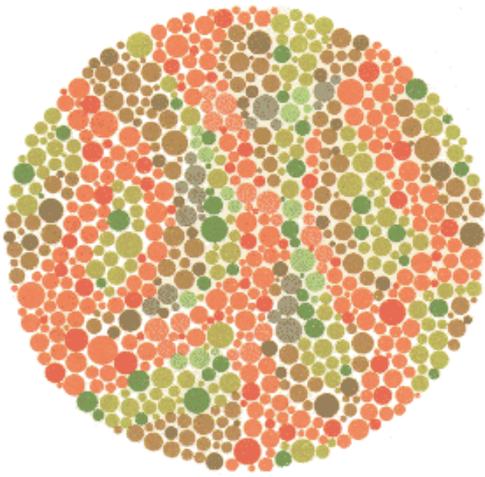
Appendix G: Four colour-scent conditions



Appendix H: Ishihara's test

Bekijkt u onderstaande afbeeldingen en geef in het tekstvak ernaast aan welk cijfer u ziet. Als u geen cijfer herkent, vul dan een X in.





Appendix I: Cognitive performance test and questionnaire

UNIVERSITEIT TWENTE.

Beste participant,

Mijn naam is Bart Hulshof en ik studeer Communicatiewetenschap met de specialisatie Marketingcommunicatie aan Universiteit Twente. Ik stel het erg op prijs dat u tijd vrijmaakt om mij te helpen met dit onderzoek. Het onderzoek bestaat uit twee onderdelen, een 'cognitive performance test' en een vragenlijst.

Probeer u zich voor het eerste onderdeel onderstaand scenario in te beelden:

'U doorloopt een sollicitatieprocedure voor een baan die u op het lijf is geschreven. U heeft al een kennismakingsgesprek gehad en vandaag volgt het tweede onderdeel van de sollicitatie: een 'cognitive performance test'. U wilt graag hoog scoren op deze test want u acht uzelf immers dé geschikte persoon voor deze baan.'

De 'cognitive performance test' bestaat uit drie onderdelen, onderdelen A, B en C. Elk onderdeel is voorzien van een korte uitleg. Na afronding van de test wordt u gevraagd een digitale vragenlijst in te vullen. In totaal zal dit onderzoek ongeveer 25 minuten in beslag nemen.

Alvast hartelijk dank voor uw deelname.

Bart Hulshof
Student Communicatiewetenschap
Universiteit Twente

Vult u uw respondentnummer in onderstaand tekstvak in:

Cognitive performance test

Onderdeel A-1

U krijgt twee matrices te zien, één bestaande uit 12 fictieve drieletterwoorden en één bestaande uit 12 afbeeldingen. Bij matrix A dient u zoveel mogelijk drieletterwoorden te onthouden. Daarnaast dient u ook de locaties van deze drieletterwoorden in de matrix te onthouden. Bij matrix B geldt hetzelfde, u dient zoveel mogelijk afbeeldingen te onthouden. Daarnaast dient u ook de locaties van de afbeeldingen in de matrix te onthouden. U krijgt voor elke matrix, matrix A en B, één minuut om de drieletterwoorden en afbeeldingen met hun locaties in u op te nemen. Op een later punt in deze kennistest dient u de drieletterwoorden en afbeeldingen met hun locaties zo goed mogelijk te herroepen.

Matrix A

GEB	DAZ	DAR	LOZ
ZUJ	VUH	FOT	BIF
WUB	RUJ	LIM	WID

Matrix B

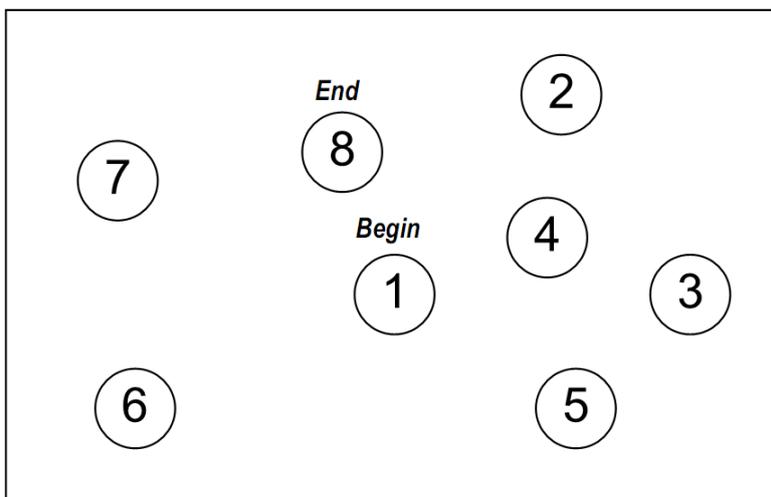


Onderdeel B

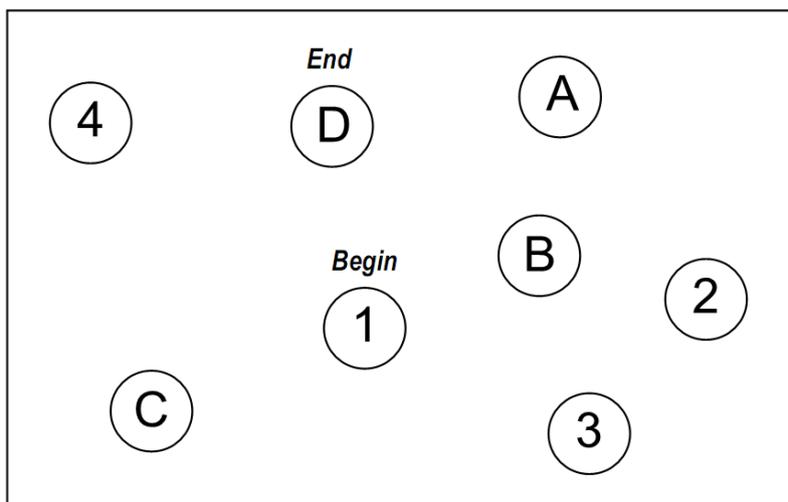
Onderdeel B bestaat uit twee testen, die beiden worden voorafgegaan door een oefenserie.

- In test 1 moeten 25 punten, aangegeven met de nummers 1 t/m 25, zo snel mogelijk foutloos met elkaar worden verbonden in oplopende volgorde.
- In test 2 zijn in het veld met punten zowel nummers als letters aanwezig. Deze moeten zo snel mogelijk foutloos als volgt worden verbonden: 1-A-2-B-3-C etc.

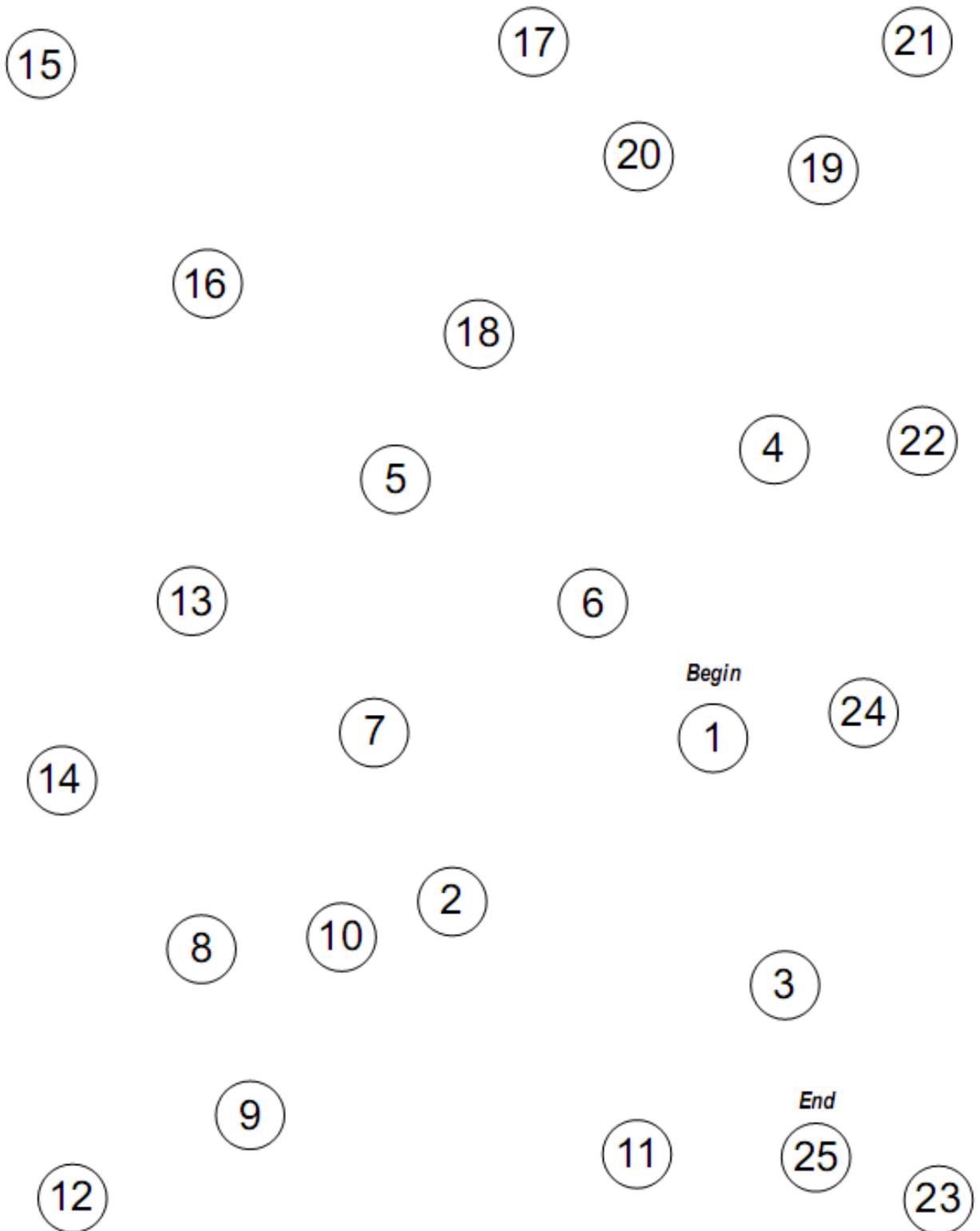
Oefenserie test 1



Oefenserie test 2

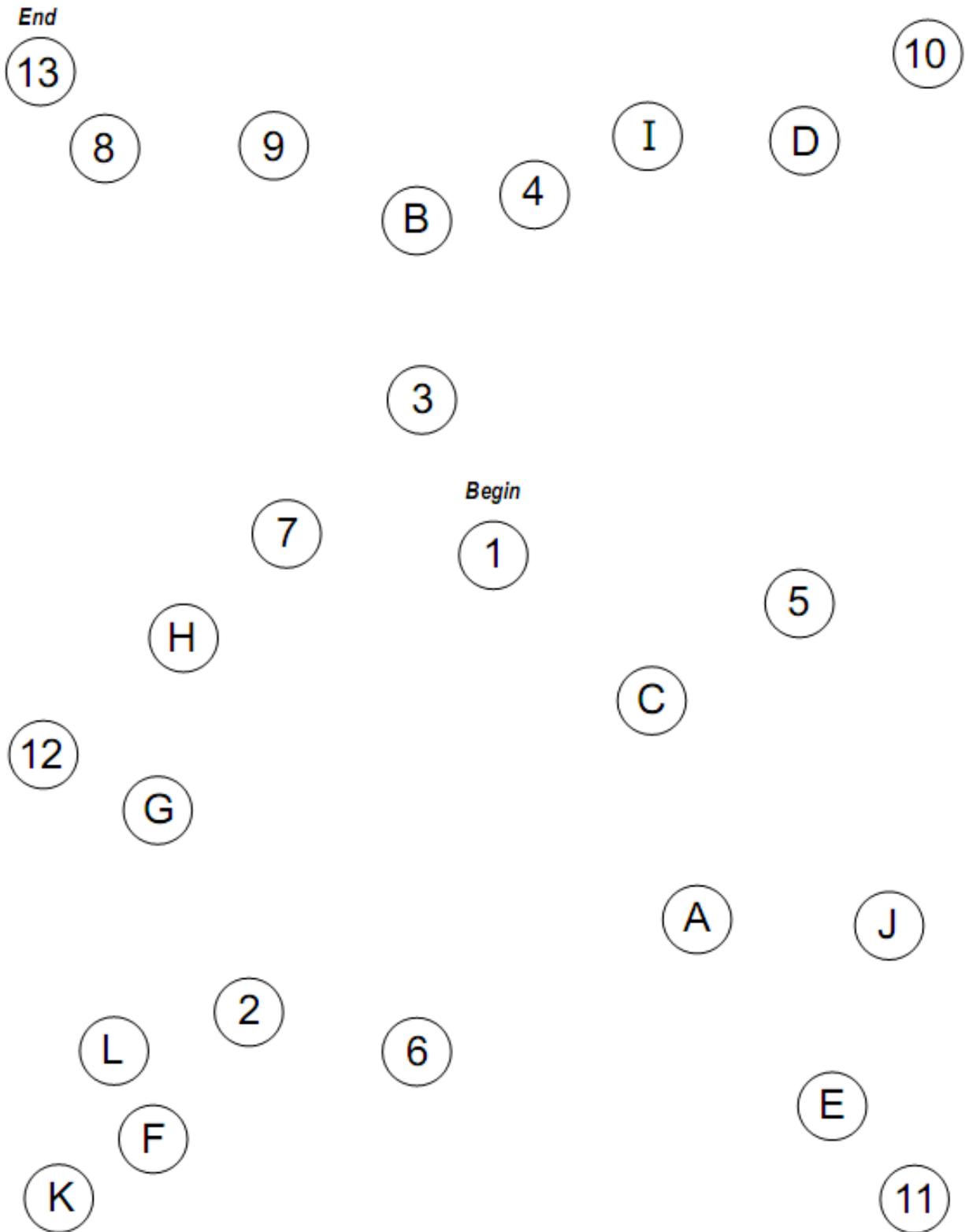


Test 1



sec.

Test 2



sec.

Onderdeel A-2

Onderdeel A-2-A

Bij dit onderdeel dient u zoveel mogelijk fictieve drieletterwoorden uit matrix A bij onderdeel A-1 op de juiste plaats in onderstaande (lege) matrix te noteren.

In te vullen door de onderzoeker:

Woorden correct

/12

Woorden + locatie correct

/12

Onderdeel A-2-B

Bij dit onderdeel dient u zo veel mogelijk namen van de afbeeldingen uit matrix B bij onderdeel A-1 op de juiste plaats in onderstaande (lege) matrix te noteren.

In te vullen door de onderzoeker:

Afbeeldingen correct

/12

Afbeeldingen + locatie correct

/12

Onderdeel C

U dient onderstaande tien vragen te beantwoorden. Er is bij elke vraag slechts één antwoord goed.

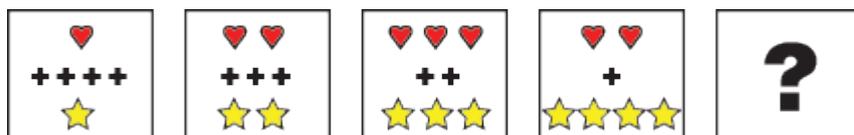
1. Welk van de onderstaande woorden is het meest hetzelfde in betekenis als het woord 'geruststellend'?

- 0 medelevend
- 0 rustgevend
- 0 uitleggevend
- 0 bemoeizuchtig

2. Welk cijfer volgt logischerwijs op de reeks: 4 - 6 - 9 - 6 - 14 - 6 - ... ?

- 0 6
- 0 17
- 0 19
- 0 21

3. Welke onderste figuur moet logischerwijs op de plaats van het vraagteken staan in de bovenste reeks?



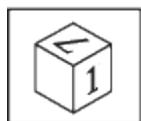
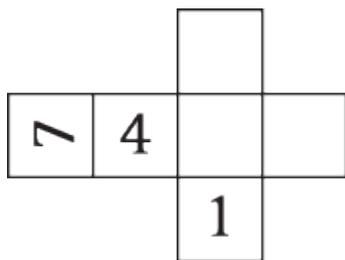
- 0
- 0
- 0
- 0
- 0

4. Welke van de onderstaande conclusies kun je met absolute zekerheid trekken op basis van de twee stellingen hieronder?

1. Geen van de postzegelverzamelaars is een architect.
2. Alle Nederlanders zijn postzegelverzamelaars.

- 0 alle postzegelverzamelaars zijn architecten
- 0 architecten zijn niet Nederlands
- 0 geen postzegelverzamelaar is Nederlands
- 0 sommige Nederlanders zijn geen architect

5. Welke kubus krijg je als je de opgevouwen kubus opvouwt?



0



0



0



0



0

6. Wat is het juiste antwoord op het volgende vraagstuk?

Tom heeft een nieuwe set met golfclubs. Met een club 8 slaat hij gemiddeld 100 meter ver. Met een club 7 slaat hij gemiddeld 108 meter ver. Met een club 6 slaat hij gemiddeld 114 meter ver. Hoe ver zal Tom met een club 5 slaan?

0 122 meter

0 120 meter

0 118 meter

0 116 meter

7. Welk woord heeft de meest tegengestelde betekenis aan het woord 'realistisch'?

0 impressionistisch

0 onwerkelijk

0 fantastisch

0 daadwerkelijk

0 onmachtig

8. Water staat tot een pijp als ... staat tot een snoer.

0 draad

0 elektriciteit

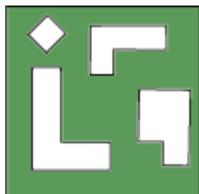
0 warmte

0 gas

9. Welk woord heeft als betekenis 'een uiting van ongenoegen'?

- 0 onrecht
- 0 klacht
- 0 vruchteloos
- 0 zonde
- 0 onenigheid

10. Welk onderstaand figuur kan samengesteld worden uit de losse onderdelen?



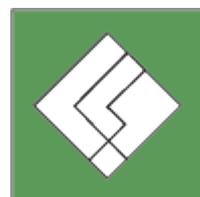
0



0



0



0

In te vullen door de onderzoeker:

/ 10

Toestemmingsverklaring

Ik ben geïnformeerd over het feit dat deze vragenlijst onderdeel is van een onderzoeks-project. Alle data is vrijwillig verstrekt en mag anoniem gebruikt worden door de onderzoeker.

.....
(handtekening)

Voor vragen of opmerkingen over deze vragenlijst of andere aspecten van het onderzoek kunt u contact opnemen met de onderzoeker via b.hulshof@student.utwente.nl.

Nogmaals hartelijk dank voor uw tijd!

Onderdeel B

Onderstaande items bestaan uit twee antwoordmogelijkheden, A en B. Geef aan welke van de twee het best uw voorkeur of gevoel beschrijft. In sommige gevallen vindt u dat beide antwoordmogelijkheden passend zijn. Kies in dat geval het antwoord dat uw voorkeur of gevoel beter beschrijft. In andere gevallen vindt u misschien beide keuzes niet passend. Kies in dit geval het antwoord dat u het minst tegenstaat. Er zijn geen goede of foute antwoorden zoals in verschillende andere testen. Omcirkel uw antwoord.

1. A. Ik hou van wilde, ongeremde feesten.
B. Ik heb een voorkeur voor rustige feesten met een goed gesprek.
2. A. Er zijn films die ik leuk vind om een tweede of zelfs een derde keer te kijken.
B. Ik kan er niet tegen een film te kijken die ik al eens eerder heb gezien.
3. A. Ik wens vaak dat ik een bergbeklimmer zou kunnen zijn.
B. Ik kan mensen die hun leven riskeren met bergbeklimmen niet begrijpen.
4. A. Ik heb een afkeer voor alle lichaamsgeuren.
B. Ik hou van sommige alledaagse lichaamsgeuren.
5. A. Ik raak verveeld bij het zien van dezelfde bekende gezichten.
B. Ik hou van de aangename vertrouwdheid van alledaagse vrienden.
6. A. Ik vind het leuk om alleen een onbekende stad of wijk te verkennen, zelfs als dat betekent dat ik verdwaal.
B. Ik heb de voorkeur voor een gids wanneer ik op een plaats ben die ik niet goed ken.
7. A. Ik heb een afkeer voor mensen die dingen doen of zeggen alleen om anderen te kwetsen of van hun stuk te brengen.
B. Als je bijna alles wat een persoon zal doen en zeggen kan voorspellen, moet hij of zij wel een saaie piet zijn.
8. A. Ik geniet over het algemeen niet van een film of voorstelling waarbij ik van tevoren kan voorspellen wat er gaat gebeuren.
B. Ik vind het niet erg een film of voorstelling te zien waarbij ik van tevoren kan voorspellen wat er gaat gebeuren.
9. A. Ik heb marihuana geprobeerd of zou dat graag willen.
B. Ik zou nooit marihuana roken.
10. A. Ik zou het niet leuk vinden drugs te proberen die mogelijk vreemde en gevaarlijke uitwerkingen op mij hebben.
B. Ik zou het leuk vinden nieuwe drugs te proberen die hallucinaties veroorzaken.
11. A. Een verstandig persoon vermijdt gevaarlijke activiteiten.
B. Ik vind het soms leuk dingen te doen die een beetje schrikwekkend zijn.

12. A. Ik hou niet van 'swingers'.*
B. Ik geniet van het gezelschap van echte 'swingers'.*
13. A. Ik vind dat stimulerende middelen me een onaangenaam gevoel geven.
B. Ik vind het vaak aangenaam om 'high' te worden (door het drinken van alcohol of het roken van marihuana).
14. A. Ik vind het leuk om eten te proberen dat ik nog nooit eerder heb geproefd.
B. Ik bestel de gerechten waar ik bekend mee ben, om zo teleurstelling of onaangenaamheden te voorkomen.
15. A. Ik geniet ervan naar thuisvideo's of vakantiefoto's te kijken.
B. Het kijken naar iemands thuisvideo's of vakantiefoto's verveelt me enorm.
16. A. Ik zou het leuk vinden te gaan waterskiën.
B. Ik zou het niet leuk vinden te gaan waterskiën.
17. A. Ik zou het leuk vinden om proberen te surfen.
B. Ik zou het niet leuk vinden om proberen te surfen.
18. A. Ik zou het leuk vinden om erop uit te gaan zonder vooraf geplande of bepaalde routes of tijdschema's.
B. Als ik op reis ga, vind ik het prettig mijn route en tijdschema tamelijk zorgvuldig te plannen.
19. A. Ik heb een voorkeur voor nuchtere mensen als vrienden.
B. Ik zou het leuk vinden vrienden te maken in meer excentrieke groepen zoals artiesten of kunstenaars.
20. A. Ik zou het niet leuk vinden een vliegtuig te leren besturen.
B. Ik zou het wel leuk vinden een vliegtuig te leren besturen.
21. A. Ik heb de voorkeur voor het oppervlak boven de diepte van het water.
B. Ik zou het leuk vinden te gaan duiken.
22. A. Ik zou het leuk vinden homoseksuele mensen (mannen of vrouwen) te ontmoeten.
B. Ik blijf weg van degenen waarvan ik vermoed dat ze homo zijn.
23. A. Ik zou het leuk vinden eens te gaan parachutespringen.
B. Ik zou nooit eens uit een vliegtuig willen springen, met of zonder parachute.
24. A. Ik heb de voorkeur voor vrienden die op een opwindende manier onvoorspelbaar zijn.
B. Ik heb de voorkeur voor vrienden die betrouwbaar en voorspelbaar zijn.
25. A. Ik ben niet geïnteresseerd in belevenissen alleen voor de ervaring.
B. Ik vind het leuk om nieuwe en opwindende belevenissen en sensaties te hebben, zelfs als ze een beetje eng, onconventioneel of illegaal zijn.

26. A. De essentie van goede kunst zit 'm in zijn zuiverheid, symmetrie in vorm en harmonie in kleuren.
B. Ik vind schoonheid vaak in de conflicterende kleuren en onregelmatige vormen van moderne kunst.
27. A. Ik geniet ervan tijd door te brengen in de bekende omgeving van mijn thuis.
B. Ik word erg onrustig als ik een bepaalde periode thuis moet blijven.
28. A. Ik vind het leuk om van een hoge duikplank te springen.
B. Ik hou niet van het gevoel dat ik krijg als ik op een hoge duikplank sta (of ik kom er al helemaal niet in de buurt).
29. A. Ik hou ervan uit te gaan met mensen van het andere geslacht die fysiek opwindend zijn.
B. Ik hou ervan uit te gaan met mensen van het andere geslacht die mijn normen en waarden delen.
30. A. Veel drinken bederft gewoonlijk een feestje omdat sommige mensen luidruchtig en onstuimig worden.
B. De glazen volhouden is de sleutel tot een goed feest.
31. A. De ergste sociale zonde is onbeleefd te zijn.
B. De ergste sociale zonde is een saaie piet te zijn.
32. A. Een persoon zou eigenlijk aanzienlijke seksuele ervaring moeten hebben voordat hij/zij gaat trouwen.
B. Het is beter wanneer twee getrouwde personen hun seksuele ervaring met elkaar beginnen.
33. A. Zelfs als ik veel geld zou hebben, dan zou ik er niets omgeven om op te trekken met wispelturige mensen zoals die in de jetset.
B. Ik zou me kunnen voorstellen dat ik plezier zoek in de wereld van de jetset.
34. A. Ik hou van mensen die scherp en ad rem zijn, zelfs als ze soms anderen beledigen.
B. Ik hou niet van mensen die plezier hebben ten koste van de gevoelens van anderen.
35. A. Over het geheel genomen is er te veel seks te zien in films.
B. Ik geniet van het kijken naar de sensuele scènes in films.
36. A. Ik voel me op mijn best na het drinken van een paar glaasjes (alcohol).
B. Er is iets mis met mensen die drank nodig hebben om zich goed te voelen.
37. A. Mensen zouden zich moeten kleden volgens bepaalde normen van smaak, netheid en stijl.
B. Mensen zouden zich op persoonlijke wijze moeten kleden, ook als de effecten soms een beetje vreemd zijn.

Zo ja, in hoeverre heeft u de kleur als opwindend/prikkelend ervaren?

Niet opwindend/ niet prikkelend	0	0	0	0	0	0	0	Opwindend/ prikkelend
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45. Wat is uw favoriete kleur?

.....

46. Heeft u geur waargenomen tijdens het invullen van de 'cognitive performance test' en de vragenlijst?

0	Ja	0	Nee	0	Ik kan het me niet herinneren
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Zo ja, in hoeverre heeft u de geur als plezierig ervaren?

Onplezierig	0	0	0	0	0	0	Plezierig
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Zo ja, in hoeverre heeft u de geur als opwindend/prikkelend ervaren?

Niet opwindend/ niet prikkelend	0	0	0	0	0	0	Opwindend/ prikkelend
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47. Wat is uw favoriete omgevingsgeur? (geen parfum of eau de toilette)

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