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Seeing Red: The Effect of Colour Priming on Detail-Oriented Performance in Achievement Contexts

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0. Abstract

Research concerning the effect of the colour red on performance in achievement contexts is still in an ambiguous state. Most notably, experiments have largely only been conducted in an artificial environment, so that there is only a small number of experiments that have attempted to test the implications of red on people's attention in a real-world environment. The laboratory experiments that have been conducted so far were mainly aimed at resolving the question whether the exposure to red triggered an avoidance motivation which would either prompt study participants to perform better in cognitive tasks or which would, to the contrary, constrain their actual attainment during achievement-oriented situations. The study at hand tries to make a small contribution to the findings of preceding research by applying its theoretical framework to the educational domain and by examining the issue in a further field experiment. Hence, 36 students were asked to learn 18 English words and their respective German translations within two minutes. While the experimental group was exposed to a red prime during vocabulary acquisition, the control group learned the words from a piece of paper that carried a neutral (black) prime. The impact of colour priming was measured by evaluating the students' performance on a subsequent vocabulary test. The present study did, however, not succeed in establishing a relationship between colours and behaviour in achievement contexts. The collected data did not reach significance which could be attributed to several external incongruities. These are discussed in the light of future undertakings that may want to further research the effect of colour priming in the school context and presents suggestions for forthcoming experimenters on how to improve the employed study design.

1. Introduction

Colours affect our lives on a daily basis without us even recognising it. Whether we see a bright blue sky the moment we leave the house or if it is grey and cloudy outside has a considerable effect on our mood. If we take the work of an interior architect into consideration, the mood influencing nature of colours becomes even more apparent: our personal interior designer will advise us on the colours to use in our bedroom that will be most effective in calming us down after a long and rough work day but will also suggest the appropriate colours for our workplace or office so as to boost our creativity and efficiency. But not only nature and certain professions display the profound link between colours and people's emotions but also language does which is exemplified by the pervasiveness of proverbs like *seeing red* or *feeling blue* in everyday language.

Due to the omnipresence of colours in our surroundings and their great power to influence us, one would assume that research on its psychological functioning has already provided extensive results. Quite the contrary is the case, however: Elliot et al. (2007) have noticed that although there are studies reporting the boosting or weakening effect of colours on cognitive (cf. Soldat, Sinclair, & Mark, 1997) and physical performance (cf. Hill & Barton, 2005), most of them are not based on theoretical frameworks but argue from an applied point of view towards psychological research. Most orientate themselves towards the Yerkes-Dodson law which implies that longer wavelength colours such as red and orange appear to arouse while shorter wavelength colours such as blue and green are regarded as having a calming effect on observers. Within the scope of this theory, the exposure to longer wavelength colours is believed to have a detrimental effect on performance during complex tasks (cf. Elliot et al., 2007, pp. 154 f.). Before Elliot et al. (2007) there had not been any empirical research that would have served to verify this assumption. And even until now, not enough studies have been conducted that enable scientists to make definite claims about how the brain processes colours or how it is possible that colours affect us to such a great extent. It is, however, agreed upon that the concept of priming plays a relevant role in the interaction between colours and emotions.

The work that has been done in the concerning domain so far has been preoccupied with the different effects of blue and red on perception and behaviour. Although the colour red has been the most prominent and frequent subject of studies, scientists came to opposing findings concerning the direction of its influence. Thus, they disagree on whether the exposure to the colour red is beneficial or detrimental in achievement contexts. The vast majority of studies that have researched the relationship between colour and performance have, however, only been conducted under laboratory conditions. Hence, what remains to be done, as Bargh (2006, pp. 163 f.) has claimed, is to explore the effects of automatic colour priming in real-world environments and how they produce real-world change. That is what I intended to do by means of my study: by taking into consideration the effect of red on students during vocabulary acquisition, I wanted to make a small contribution to the discussion.

2. Theoretical background

The theoretical background that is essential to my study concerns the functioning of the memory system and the storage of words in the mind, the process of priming, and how colour associations are evolutionary and culturally determined.

2.1 The functioning of the brain in creating memories and storing words

Everything that is perceived by a human being through auditory, visual or tactile canals is filtered by the sensory buffer before it enters the working memory. The sensory buffer is also called ultra-short-term or immediate memory. Its functioning depends on the interaction between the medial temporal lobe and the hippocampus. It decays extremely quickly and enables us, for example, to still remember the beginning of a sentence when its end is reached or is responsible for putting together individual visual fixations to result in an entire image when we are looking at a picture or somebody else's face (Baars & Gage, 2010, pp. 40 f.). Information that has been perceived as sensory input becomes available to the short-term or working memory if it has caught our attention (Baars & Gage, 2010, p. 45). It also only has a limited capacity and may last for seconds to minutes. According to Cowan (2005, p. 155) the "[w]orking memory is the set of mental processes holding limited information in a temporarily accessible state in service of cognition." From here, information is processed and either encoded into long-term memory or it leads to the initiation of the planning and execution of actions. The transformation from short-term to long-term memory is called consolidation and involves the interaction between the medial temporal lobes and alterations in the cortex. It has been found that long-term memory is stored all over the brain but that its formation is processed in the hippocampus. The latter, however, seems to play no role in the maintenance or retrieval of long-term memory (cf. Baars & Gage, 2010, pp. 322–325).

A memory can be described as a lasting mental representation which is reflected in experience, thought, and behaviour (Baars & Gage, 2010, p. 305). The implicit or explicit acquisition of said mental representations is called learning. While the term explicit memory is used to describe the process of intentional learning and the retrieval of conscious knowledge, implicit memory refers to the learning and accessing of unconsciously acquired information that can be rather observed by a change in behaviour than by conscious recall. The action which includes the unconscious learning can, however, be performed consciously. Thus, learning how to ride a bicycle involves that the learning person is aware of the action as such but probably unconscious of the underlying processes that allow him or her to succeed in the action itself (cf. Wager & Koutstaal, 2002, p. 27). Explicit memories are collected in the declarative long-term memory which comprises the storage of perceptual, episodic and semantic memories. Implicit memories are, however, saved in the non-declarative long-term memory which involves implicit memories, habits and motor skills, and primed biases and goals (Baars & Gage, 2010, p. 309).

Concerning the storage of words, two relevant hypotheses of how knowledge may be structured within the mind can be described. In order for the brain to be able to process the great amount of information that enters the mind, it is fundamental that the various existing concepts are arranged economically. That way information may be retrieved time efficiently. At first it was assumed that this was the case if words were stored according to their semantic relation to each other. Consequently, the meaning of a word was believed to depend upon its relations to countless other words in the mind to which it is linked. This structuralist approach known as semantic field theory which was popular in the 1930s was replaced in the 1980s by the cognitive approach which presupposes that meaning is structured by means of conceptual categories within the mind. In contrast to the semantic field theory, the cognitive conceptual approach assumes the categorisation of words according to experience, i.e. as a result of the comparison of new things with already known ones and the ensuing similarities between different entries (Becker & Bieswanger, 2006, p. 149). Two concepts of semantic and conceptual networks are noteworthy in this context: the concept of

hierarchical networks as described by Collins & Quillian (1969) and its derivative realised in the spreading activation model (Collins & Loftus, 1975). The hierarchical network model represents concepts and its characteristics in a particularly economic manner. Concepts are hereby divided into super- and sub-categories. The more information is comprised by a term the higher it is situated in the hierarchy. The concept can, therefore, be described as proceeding top-down from the general to the specific. Thus, the term *food* representing vegetables as well as meat may be associated with sweet, sour, or bitter flavours and can refer to liquid and solid consistencies. It would, therefore, appear at the very top of the taxonomy. Hierarchical networks seem to be very efficient at first sight because every characteristic only needs to be presented once within the construct since the terms on superordinate levels already include those on subordinate levels. Furthermore, concepts are presented with their internal relations to each other. It is assumed that the closer the relation between two concepts or words is the faster an association can be retrieved (Collins & Quillian, 1969).The model has mainly been criticised for two points, i.e. its failure to incorporate the prototypical model (e.g. when the concept of *fruits* is activated most people first think of an apple and not of a lychee, which would, however, not be visualised within in a hierarchical taxonomy) and its assumption that the knowledge of a concept's general characteristics is foremost based on individual experiences. Thus, it is likely that certain characteristics are not only represented once within a hierarchical construct but numerous times depending on someone's individual experiences (cf. Wessels, 1994, p. 256).

The spreading activation theory as presented by Collins and Loftus (1975) can be seen as a further development of the hierarchical model. According to the authors, the activation of one concept automatically initiates the activation of other concepts that are linked to the first. Two theories can be consulted to account for the process of spreading activation. In accordance with the Hebbian theory which is that what fires together also wires together, the first thesis implies that two concepts that frequently occur together establish a stronger link and may, therefore, be more easily accessed (cf. Hebb, 1949). The second theory contains that activation spreads from node to node, provided that two nodes are

interconnected via an associative link, and that the exuded strength of the stimulus varies according to the strength of the initial activation and the semantic distance between two concepts. The distance is determined by how many associative steps separate concepts from each other which is often dependent on the number of conceptual features they share. Along with this hypothesis, activation decays and gets weaker the longer it has travelled. Hence, concepts that are only loosely associated are activated less strongly. If the initial activation is not strong enough, the spread will also be only limited to closely associated concepts (cf. Mc Namara, 1992). Meyer and Schvaneveldt (1971) have illustrated this phenomenon in an experiment: they found that the word *nurse* was responded to more quickly if it had been preceded by a word that was conceptually associated with it, e.g. *doctor*. It can, thus, be suggested that the activation of the concept *doctor* at node A has led to a near simultaneous activation of the concept *nurse* at node B, so that when the word *nurse* was presented to the study participants the corresponding node had already been prepared. The mental representation that had been activated was more accessible and could, therefore, be more easily retrieved which accounted for the quicker response. The process in which the presentation of an initial stimulus automatically and unconsciously influences a person's perception of, attitude or behaviour towards a subsequent target stimulus is known as priming and will be considered in the following part.

2.2 How priming facilitates the retrieval of memories

For a long time it has been believed that humans deviate from other living beings in terms of their ability to make conscious decisions and intentionally act according to their free will. It has become increasingly apparent, however, that also human beings and their actions are determined by their perceptions of the environment which may unconsciously influence a person's attitudes, judgements, motivation, and ultimately his or her behaviour. Thus, decisions that seem to emanate from a thorough decision process have to a substantial part already been made by our subconscious. The unconscious influence of an initial stimulus on a target stimulus is called priming and the stimuli involved in the process are referred to as primes.

The Oxford Learner's Dictionary (2011) defines *to prime* as "[preparing] somebody for a situation so that they know what to do, especially by giving them special information" and "to make something ready for use or action". Consistent with the word meaning, the priming effect is referred to if an external stimulus passively initiates an internal readiness within a person to respond to a second stimulus, the target prime, by temporarily activating mental representations of a certain concept. As long as the activation persists, the mental representation exerts an unconscious effect on the perceptions, evaluations, and motivation of a person (cf. Bargh & Chartrand, 2009).

Karl Lashley (1951) who was concerned with the functioning of spoken language first used the term *priming* to describe the process that mediates between the intention of uttering a sentence and the concrete action of pronouncing it in order to produce fluent speech. Lashley (1951), however, attributed the initiation of the process to an internal and intentional event of activation which stands in opposition to the concept's actual functioning. Storms (1958) was the first to conduct a study which demonstrated the priming effect as it is known today. He provided half of his study participants with a word list they had to learn before accomplishing a free association task. He found that people who had been exposed to the word list primarily reproduced words that they had memorised while the control group who had not been given a word list thought of completely

different words. Although Storms (1958) succeeded at describing the effect of priming, he failed to attribute it to the term introduced by Lashley (1951). This was ultimately accomplished by Segal and Cofer (1960) who executed an experiment that replicated Storms' (1958) study and who referred their findings to the concept of priming. From that point onwards, priming research has constantly extended its scope: after research had at first been limited to perceptual priming, scientists became increasingly interested in how the way other people are perceived by individuals may be affected by priming (cf. Higgins, Rholes, & Jones, 1977) and started to research its role in influencing behaviour (cf. Bargh, 1996) as well as people's motivation and goals (cf. Bargh & Gollwitzer, 1994). Recent studies have sought to establish to which extent people are influenced by everyday environmental cues and which impact that may have on daily decision-making processes (cf. Berger & Fitzsimons, 2008).

Priming is particularly used to test for implicit memory which "is not accompanied by conscious awareness that one has a memory; the memory's existence is inferred only from the effects it has on behaviour. Implicit memories may be retrieved without an intention to remember" (Baars & Gage, 2010, p. 310). Priming tasks that operate on an unconscious level are, therefore, a convenient measuring instrument. The perceptual priming technique which is often employed in testing for the impact of colours usually involves the exposure to a direct prime that is either subliminally (unconsciously) or supraliminally (consciously) perceived. Lately, especially in advertisement it has been strived to acquire knowledge about how environmental cues, like colour, may influence people and their consumer behaviour in everyday situations. Berger and Fitzsimons (2008) pose a prominent example for establishing that the exposure to colour plays an elevated role in consumers' product choice. In an experiment that sought to test their hypothesis one of the researchers carried green and orange pens that wrote in the corresponding ink colour in his pocket and approached test persons arbitrarily to allegedly inquire what kind of products they liked. He reached into his pocket and handed each participant a pen, thereby randomly assigning them to the orange or green experimental group. To ensure that the test persons had been exposed to the ink colour, he asked them to give a short written

account of the book they had last read. After that he showed them pictures of beverages, candies and detergents of which some related to the colour orange, some to the colour green, and some to neither and asked the participants which of the products they preferred. As Berger and Fitzsimons (2008) had predicted, study participants made their product choice in accordance with the ink colour of the pen they had been handed previously. Exposure to a certain colour, thus, may influence people on an unconscious level even if presented supraliminally.

Elliot et al. (2007, pp. 155–156) have described how the prevalence of colours shapes people's consciousness already from early childhood onwards. Colour concepts are in most cases learned associations. They do not only have aesthetic value but also carry specific information and convey particular messages. Encountering a link between the exposure to a specific colour and the occurrence of a particular behaviour repeatedly, installs a permanent association so that whenever a colour appears it may in accordance with learned associations unconsciously affect behaviour. Therefore, Elliot et al. (2007) have assumed that "once a color association is in place, color is presumed to operate as a nonconscious prime and have an automatic influence on psychological functioning" (p. 156). That means that whenever we perceive a colour, it has a substantial influence on our behaviour which will be elaborated on in more detail in the subsequent part.

2.3 The role of evolution and culture in establishing colour associations

Blue, the colour of the sky and the ocean, and green, the colour of leaves, trees, and forests, calm and relax. The two colours are linked to concepts of silence and freedom. Red, the colour of fire and blood, on the contrary, is associated with agitation and danger. Of course, there are exemptions to the rule: red is also highly connected with love, green with poison, and blue is also often related to sadness and depression. Word association tests have, however, shown that the first mentioned associations significantly predominate (cf. Spitzer, 2009, p. 320). Therefore, objects that intend to call our attention or serve to warn us are red. Stop signs make us aware that we are approaching a dangerous crossing and the sight of an ambulance prepares us for a nearby hazardous situation. In both cases, our reaction is to slow down and focus our attention on possible perils. We behave as to prevent anything from happening to us. To put it another way, we show avoidance behaviour. Kurt Lewin (1935) has distinguished between approach and avoidance motivation in spatial terms: while approach motivation leads to the intention of decreasing the distance between a person and a desired object, avoidance motivation involves any behaviour that serves to increase the distance between the self and a threatening object. In this context, Elliot and Maier (2007) have reported of a study that succeeded to verify the spatial dimension of approach and avoidance motivation. In this study, the body movements of participants were measured with a sensor at the particular moment of being presented with an IQ test that they ostensibly had to take. In those instances, when the IQ test was provided with a red cover sheet, test persons moved their bodies away from the IQ test to a greater degree than when they were presented with a green or grey cover sheet. It can, thus, be suggested that participants tried to increase the distance between them and the object that may bring about a diminution of self-efficacy and that they did so to a greater extend when they were confronted with the colour red than when they were exposed to green or grey.

In order to succeed in protecting ourselves from any harm, we have to act accurately, focus our attention on the process and filter out anything that may potentially disrupt our concentration (Spitzer, 2009, p. 320). Red is the colour used to evoke the described behaviour. In the reverse manner, blue and green are primarily associated with positive conditions that may put our mind at ease and rest. Such a state of mind allows for creativity to develop because attention is not required to be limited but encouraged to expand. While blue makes people explorative, i.e. more likely to try new things, exposure to red leads them to choose the option they are already acquainted with (Mehta & Zhu, 2009, pp. 1226 f.).

Colours have always played an elevated role in our lives. As early as in the Stone Age it was important to demonstrate quick reflexes and reactions at the sight of a sabre-toothed tiger to survive, whilst without periods of rest lying under a blue sky in front of the cave the wheel or script would have probably never been invented (Spitzer, 2009, p. 320). Also in biology, "red coloration on the face or chest signals dominance to potential opponents and is associated with avoidance or withdrawal behavior in conspecifics" (Meier et al., 2012, p. 1). The colour red has already played an important role in Darwin's theory of the struggle for existence that describes the concept of the survival of the fittest. From an evolutionary and biological point of view it may, thus, be assumed that colour associations are innate.

The awareness of colour and its meaning is not only considered to be genetically determined, though, but also thought to be established by cultural influences. Cultural associations are, however, culture-specific. While in western countries white, for example, is associated with marriage and birth, it is the traditional colour of grief and mourning in India. Albeit the intercultural differences associations are acquired similarly cross-culturally: from earliest childhood onwards, people are exposed to the meanings of different colour concepts and constantly assess the respective relevance for their lives. Due to the omnipresence of colours this happens so frequently and extensively that the established link between a colour and its association becomes habitual. That means that whenever related concepts are encountered, associations are

automatically activated to evaluate the situation (Elliot et. al., 2007, pp. 155f.). Such an automatic activation of mental representations is described by the concept of priming.

Motivated by such findings, researchers have started to study the impact of colours on the accomplishment of cognitive tasks. Red and blue have been the preferred subjects of these studies. So far, scientists have, however, arrived at opposing conclusions: while Stone (2001) as well as Kwallek and Lewis (1990) have observed a generally advantageous effect of red in achievement contexts, Elliot et al. (2007) at the front line but also Soldat, Sinclair and Mark (1997) have found that the exposure to red leads to impaired performance in cognitive tasks. Mehta and Zhu (2009) have pursued a reconciling approach that assumes that red has an enhancing effect in detail-oriented tasks while blue turns out to be more supportive during creative tasks. Lichtenfeld et al. (2012) who, in the first place, have supported the hypothesis that red had a detrimental impact on performance outcome, however, have failed to replicate earlier findings in a later study: while examining the influence of green on creativity, they could not find a considerable negative effect of red on performance but observed the same impact for red as for the control colour grey on study participants. The studies conducted by Elliot et al. (2007) and, in contrast to that, by Mehta and Zhu (2009) will be analysed in more detail in the following because they represent the two opposing parties the best.

2.3.1 Red has a negative effect on performance in achievement contexts

Elliot et al. (2007)[1] believe that red "[impairs] performance on achievement tasks, because red is associated with the danger of failure in achievement contexts and evokes avoidance motivation" (p. 154). Achievement contexts are defined by the authors as situations in which cognitive competences get evaluated and which include the possibility of either a positive (success) or a negative (failure) outcome (p. 156). According to them, the fear of failing has been induced by students' associations of red with teachers' corrections being made in red ink. Research has repeatedly shown that the fear of failure has a detrimental effect on performance because the possibility of encountering a negative result in an examination leads to a behaviour that tends to avoid an unfavourable outcome but ironically simultaneously causes it. This "motivational tendency to avoid failure negatively impacts performance by producing anxiety, task distraction, and a host of self-protective processes (e.g., disidentification, selection of easy tasks, self-handicapping […])" (p. 156). Due to the extensive associations between colours and concepts, avoidance motivation is initiated without the subject being aware of it, nevertheless undermining its performance in the specific achievement context (p. 156).

To prove their theory, Elliot et al. (2007) have executed several experiments on the one hand to verify the role of red in accounting for impaired performance and on the other hand to establish the existence of a relation between the colour and avoidance motivation. To reach the first mentioned aim Elliot and colleagues (2007) prepared four experiments in which they succeeded to show that even the shortest exposure (two seconds) to the colour red sufficed to result in a smaller number of solved anagrams, analogies, or numerical sequences in comparison to green or an achromatic colour (black, white, and grey). The experiments were executed in a laboratory and in a real-world classroom environment. In order to be able to attribute the undermined behaviour to the colour red, Elliot et al. (2007)

[1] The following statements, unless otherwise indicated, all make recourse to Elliot et al.'s (2007) study and are therefore only provided with the respective page numbers omitting the full reference.

conducted two experiments. In the first experiment, based on the risk-taking model by Atkinson (1957), which assumes that individuals that are faced with a situation in which they are likely to fail try to evade the task if they get the chance to do so, it was left up to the participants to choose the task difficulty that they wanted to work on in the context of an IQ test after having been primed with red, green or grey. The researchers found that participants that had been exposed to red actually chose to work on more easy-level tasks than those who saw a green or grey rectangle before making their decision. Davidson and Irwin (1999) have assumed that avoidance motivation can be visualised in an EEG and thus be observed in form of a greater activation in the right frontal cortex than in the left. Elliot et al. (2007) have been able to identify the same EEG asymmetry in a further experiment.

In a follow-up study, Elliot et al. (2007) have found that the avoidance motivation induced by the sight of red could also be observed in the body movements of test persons when they were confronted with an IQ test that carried a red cover sheet: they intuitively backed away and tried to bring more distance between them and the paper. Besides, Elliot et al. (2007) have held the opinion that red has different effects depending on the context in which it occurs. While their earliest research in this area had focussed on achievement contexts, recent experiments have revealed that red has the contrary effect in romance-related contexts. Meier et al. (2012) have only recently evidenced that people walked quicker towards a room in which they expected to be dating somebody wearing a red t-shirt than when they thought that they were being assessed by somebody dressed in red.

2.3.2 Red has a beneficial effect on performance in detail-oriented tasks

Mehta and Zhu (2009)[2] came to a different evaluation of red and demonstrated "that red and blue activate different motivations and consequently enhance performances on different types of cognitive tasks" (p. 1226). In line with Elliot et al. (2007), Mehta and Zhu (2009) believe that red culturally and evolutionary induced leads to avoidance motivation but that this has an advantageous effect in detail-oriented tasks while it is detrimental in creativity-related assignments where blue is beneficial. Based on Atkinson (1957), they have hypothesised that the exposure to red activated an avoidance behaviour that would in turn reduce the participants' willingness for risk-taking behaviour and lead to a more focused work on tasks, bestowing more attention to each and every detail. An approach motivation caused by the stimulation with blue, by contrast, would lead to a state of mind that allows for more creativity and for the testing of innovative solution strategies and, therefore, would result in a more risk-taking and explorative course of action (p. 1226 f.). In order to prove their theory, Mehta and Zhu (2009) performed six studies. The first study intended to show that red activated avoidance motivation while blue initiated approach motivation. Participants were asked to solve twelve anagrams that were presented either with a red, blue or neutral background. Three of the anagrams related to avoidance motivation (e.g. *prevent*), three made reference to approach motivation (e.g. *adventure*) and the remaining eight did not agree with either (e.g. *computer*). As anticipated, those primed by blue showed a shorter response time when solving approach-related anagrams while test persons in the red condition responded faster to avoidance-related anagrams (p. 1227). In a second task, participants were asked to rate products on the basis of their respective preference. Half of the products were described as preventing an unwanted condition while the other half promised to bring about a desired effect. Test persons in the blue colour setting tended to prefer the approach-orientated products, in contrast to the red colour condition

[2] The following statements, unless otherwise indicated, all make recourse to Mehta and Zhu's (2009) article and are therefore only provided with the respective page numbers omitting the full reference.

group that largely favoured the avoidance-related products (p. 1227). In the second study, the influence of red was tested in a memory performance task. Participants were asked to memorise 36 words within two minutes which they had to recall after a delay of twenty minutes during a free association task. Mehta and Zhu (2009) have assumed that the exposure to red would increase the memory performance induced by avoidance motivation and would lead participants to lay greater focus on details because of their increased attention. Participants who were tested in front of a red computer screen were actually able to remember more words after twenty minutes than those that were presented with a blue or neutral prime. Additionally, test persons in the blue colour condition exhibited more false recalls. In a second part, participants were required to accomplish a creativity task during which they were asked for as many creative usages for a brick as possible. The number of ideas and the degree of creativity were evaluated by independent raters and results revealed that participants in the blue colour condition came up with more creative usages than those in the red condition group (p. 1227).

The third study sought to generalise the second study's findings. Also here, Mehta and Zhu (2009) have been able to establish that test persons who had been exposed to a red computer screen performed better in a proof-reading task that required a high degree of attention and an eye for detail while participants having been primed with blue produced more correct answers in a Remote Associates Test (p. 1227 f.).

In the fourth study, Metha and Zhu (2009) intended to test both effects within one task. They, therefore, presented participants with twenty parts, either in red or in blue, from which five had to be chosen in order to construct a children's toy. Participants that were meant to build the toy from red parts thought of designs that were more practical and appropriate while those designed by the blue group were rated more novel and original (p. 1228).

The fifth study dealt with the impact colours make on perception in the framework of advertising. It could be established that posters that focussed on the details of the advertised product were more effective if they were surrounded by a red frame while advertisements that were just remotely associated with the

product were judged to be more convincing when they were perceived with a blue colour frame (p. 1228).

In a last study, Metha and Zhu (2009, p. 1228) have reviewed whether participants were aware of the influence colours may exert on a person's affect, cognition, and behaviour. The experimenters, therefore, told participants that they could choose whether they wanted to have a blue or a red background screen for working on a detail-oriented or a creativity task. In both cases, the majority of people chose the blue background independent of the kind of task they were supposed to solve. Thus, participants showed a general preference for the colour blue from which can be deduced that they were not aware of the beneficial effect of red in detail-oriented tasks.

2.3.3 Controversial findings as motivation for the present study

As should have become apparent by the thorough presentation of the two most influential studies researching the effect of red, scientists have failed to agree on the ultimate impact red may have on learning. The authors of both studies have stated that red causes avoidance motivation which is induced by learned associations that have established such a strong link between a specific colour and its implication that the latter is automatically retrieved at mere sight of the colour. Furthermore, there seems to be an evolutionary predisposition for interpreting colours and their potential alerting character in dangerous situations. This becomes evidential when fauna is taken into consideration where the survival of the fittest is still often ensured by displaying red body parts.

While both have found avoidance motivation to be involved in the solving of assignments under the exposure of red, Elliot et al. (2007) and Mehta and Zhu (2009) have reached opposing results in the task that asked participants to solve anagrams. It has to be questioned, however, to which extent the two experiments are comparable at all: while Elliot et al. (2007) evoked an examination situation by employing IQ tests, the tasks were not embedded in a similar achievement context by Mehta and Zhu (2009). Especially in the case of their word memorisation task, participants were merely requested to recall as many words as possible without indication that they were being judged for their performance. They had to act under extreme time pressure, though. It is, thus, important to highlight that Mehta and Zhu (2009) tested red in a detail-oriented task but its achievement orientation is uncertain. There is the possibility that participants would have performed poorer in the relevant task, if their self-efficacy had been threatened to be compromised. As may be concluded from the report, participants probably were not even aware of how many words they had learned initially and how many of them they were later on able to reproduce. Thus, they could not even estimate how well they had performed in this task.

Since in the school context, a good overall mark follows from the sum of various successful accomplishments, vocabulary tests endanger the students' self-efficacy to a great extent. Therefore, the mixture of Elliot et al.'s (2007) and

Mehta and Zhu's (2009) approach may provide crucial insights for the foreign language classroom.

3. Research question and hypothesis

As has been elaborated on in the preceding chapter, existing research has described inconsistent findings concerning the effect of the colour red on performance in achievement tasks. Since studies have primarily been confined to the laboratory, I intend to observe the functioning of colour in a real-world context with my experiment. The research question that my study tries to answer is if students who have been exposed to the colour red during the memorisation of the same list of words perform better or worse – i.e. retrieval of more (less) words with a minor (higher) error rate – in a subsequent vocabulary test than students who have been presented with a neutral (black) prime during vocabulary acquisition. In accordance with findings by Mehta and Zhu (2009) and encouraged by Lichtenfeld et al.'s (2012) failure to attribute a negative effect on creativity to the colour red, it may be possible that the presentation of a red prime during vocabulary acquisition leads to better performance in a subsequent vocabulary test. Lichtenfeld et al. (2012) have credited their results that deviated from their original hypothesis to the possibility that insufficient pressure to perform had been exerted on the participants. Also Mehta and Zhu (2009) conducted their experiment under low pressure conditions in that the participants were merely asked to freely recall the words they were able to remember from an earlier memorisation task. In contrast to this, Elliot et al. (2007) employed IQ tests to simulate an achievement context that threatened the participants' self-efficacy and found a detrimental effect of red in achievement-contexts. They, on the other hand, failed to distinguish between detail- and creativity-oriented tasks.

Generally speaking, it is my aim to contribute to the resolution of the discrepancy whether the colour red is likely to improve or impair performance in detail-oriented tasks. I, thus, hypothesise that the students who are exposed to the red-framed word list will either be able to recall significantly more words and show a minor error rate or demonstrate an impaired performance by recalling significantly less words and showing a higher error rate.

4. Method

The study was conducted in two classes in year ten. In both classes the mean age of students amounted to 15 whereby all students had already completed their fourteenth year. The study employed an independent groups design by randomly assigning one class to the experimental and the other one to the control group. That was achieved by randomly picking one pile of externally indistinguishable envelops that either contained word lists carrying a red or a neutral (black) prime. In that manner, it was also tried to ensure that the experimenter was blind to the participants' colour condition throughout the experiment. The red frame on the word list sheet served as the independent variable and the outcome of the subsequent vocabulary test was used as the dependent variable.

The experimental group consisted of 16 students (n = 16) of which eight were male and eight female. The control group had 20 students (n = 20). Nine of them were male and eleven were female. To ensure the comparability between the groups, attention was paid that the students had the same age, were all native speakers of German, and had learned English as their first foreign language. Three students deviated from the prerequisites in terms of the order of foreign language acquisition: three participants had learned English as their second language but since no remarkable variance of results could be discerned their data was not exempted from the sample and will not be mentioned again hereafter. The most important factor in deciding on the selected sample was to assure that the study could be conducted under similar preconditions, i.e. framed by the same subject content taught by the same teacher who covered the same topic during the lesson. The purpose of embedding the experiment in that manner was to diminish potential further variables that could be responsible for an improved or impaired students' performance in the vocabulary test. All participants had normal or corrected-to-normal sight. Dyschromatopsia was ruled out by application of the Ishiara test for colour-blindness. The study orientated itself in its composition by Mehta and Zhu's (2009, p. 1227) word memorisation experiment. In order to ascertain that not the different shade of the red prime accounted for a diverging

outcome, the same HSL (hue – saturation – lightness) scheme as in Mehta and Zhu's (2009) experiment was used (hue = 0, saturation = 240, lightness = 120).

Mehta and Zhu (2009 b) have specified in the additional online information of their study that they chose 36 words for the participants to memorise and have given as examples *sweater, accountant*, and *violin* (p. 3). After a delay of twenty minutes they measured via free recall how many words the participants had remembered. While the framework was maintained for the purposes of the present study, the words were adapted to match the premises of the English foreign language classroom in order to be relevant for the real-world context. It, thus, was decided not to let the students memorise 36 single words but 18 English vocabularies and their respective German translations. The choice, furthermore, was not limited to concrete nouns but additionally included three abstract nouns, as well as verbs and adjectives to the same amount (six each). The words were carefully chosen in order to be appropriate for the students' language level but still unfamiliar. On a preliminary discussion with the English teachers of the two classes it was established which textbook was used during lessons and it was inquired how far the students had already proceeded within it. Both teachers acknowledged that they used an English textbook for the sixth year of language learning but that additionally prepared the students for the transition into the *Sekundarstufe II.* Moreover, they stated that they had just started to work on the topic of *Our World* and environmental issues. Keeping that information in mind, words were picked that emanated from the same thematic field but were taken from the sixth year textbook that did not additionally prepare students for their entrance into the *Oberstufe* which deals with different vocabulary. To avoid the primacy-recency effect during vocabulary acquisition, two varieties of the word list were prepared which contained the same items but in a different order. Additionally, another order was employed during the vocabulary test. It was opted for the use of a vocabulary test instead of a free recall task in order to simulate an achievement context. Furthermore, the recall phase was required to be school relevant to produce results that make a valid assertion about colour priming in the school context. The employment of a vocabulary test to evaluate the effect of the exposure to red is also the decisive difference to Metha and Zhu's (2009)

experiment since their failure to create an achievement context could explain why their study participants did not show an impaired performance. In the present study, it was attempted to raise pressure from the beginning of the experiment by limiting the time for the vocabulary acquisition to two minutes and by telling the participants before they started to learn the vocabulary that they were to pay attention to translation and spelling since they were going to write a vocabulary test after a delay of twenty minutes in which the German words were given and the corresponding English translation had to be provided by them. It was hoped that the mere announcement of a test would raise sufficient pressure to achieve to account for an achievement context. In order to ensure that the learned words were not used in the subsequent English lesson and would, therefore, be more accessible in the recall phase, the experiment was conducted during chemistry class. This circumstance also provided a good pretext for what was tested to keep the participants unaware of the study's actual aim. The students were told that the experiment was striving to find out if a relationship between analytic thinking and vocabulary acquisition existed. Since the procedure had been applied in both groups potential consequences of the teaching of chemistry during the time of consolidation would be effective in both groups. It was also ensured that the two groups were both dealing with the same subject that had in both cases a similar level of difficulty.

The groups were tested the same day, in the same room, during a lesson of chemistry that was taught by the same teacher and dealt with the same topic (structural formulas). First, students were informed about the alleged purpose of the study, namely to examine the relation between analytic thinking and vocabulary acquisition and about the subsequent procedure. In order to avoid expectancies by the experimenter, the word lists were put into externally undistinguishable envelops and handed to the students. The students were requested to open their envelopes at a sign. From that moment on, they had two minutes to memorise the English vocabularies with their corresponding German translations. During the acquisition phase the experimenter was careful not to pay attention to the process in order to remain blind of which group was the experimental group. As studies have shown, an insufficient blinding of

experimenters can unintentionally influence the behaviour shown by test persons. After two minutes the experimenter told the participants to please stop and put the lists back into the envelopes. The experimenter marked the envelopes to know later on which group was the experimental group. The teacher started his lesson. During the next twenty minutes the experimenter kept quiet. It was taken into consideration that the experimenter should leave the room in the interim period, but it was refrained from doing so because there would be no control function whether students might have talked about the words or were exposed to the prime for another reason. To establish that the prime was not overwritten by other colours, the experimenter had asked the chemistry teacher not to use any coloured chalk or highly coloured pictures and graphics beforehand. After twenty minutes the experimenter distributed the vocabulary test. Students were given five minutes to complete the test to build time pressure. After the time had passed, the students were explicitly asked to omit their name on the tests which were collected and the short questionnaire with an attached Ishiara test was distributed. The questionnaire asked for the students' gender and whether English was their first or second foreign language. To be able to account for potentially irritating later results, control questions were included. These comprised questions for the students' preference and affinity towards the subject English, inquired about the overall mark in the subject on the previous school certificate, and asked for the effort that was put into trying to acquire the words, how concentrated students' had been during the process and how difficult they had experienced the retrieval of the vocabulary. At the end of the questionnaire students were debriefed by being required to summarise what the study had been about in their opinion. No student was aware of the real purpose of the study. Before the students started to fill in the information on the questionnaire, they had been informed that their participation in the study was voluntary and that their non-participation would have no influence on any of their school achievements. They were given the option to leave blank the formula and thereby decline their consent that their data could be used for scientific purposes. All students submitted a completed questionnaire. Only then the real intention of the study was revealed. The procedure was repeated in the second group.

5. Results

As was established subsequent to the study's completion, the first class that had been tested revealed to be the control group (n = 20) and the second one the experimental group (n = 16).

The answers given in the vocabulary test were categorised into four groups: the results were considered under the premises of how many words were recalled in general (1), how many of those were written correctly (2), how many words were recalled and matched correctly with their respective translations (3), and how many of those were matched and additionally spelled correctly (4).

The participants of the control group were able to recall averagely eight words in total, of which 6.1 in the mean were also correctly spelled. The experimental group recalled only a slightly higher number of words in the average, namely 8.88 words, of which 7.19 were recalled and also written correctly. Thus, the experimental group reproduced 0.88 more words in the average and additionally spelled 1.09 more words correctly. The class that functioned as the control group matched 7.45 words in the mean with the correct German translations and wrote 5.75 words the correct way. The experimental group was able to match 8.44 words with their respective translations and 7 of those were in the average also spelled correctly. Accordingly, the experimental group managed to match 0.99 words more than the control group and, in the mean, wrote additional 1.25 of the matched words correctly. The variation was in all cases rather large and ranged from 3.1 to 3.83. Details may be taken from the Table 1 and Chart 1 below.

Table 1: Average results of recalled words in total (1), with correct spelling (2), correctly matched words (3), and correctly matched and spelled words (4) for the control and experimental group.

	(1)	**(2)**	**(3)**	**(4)**
control group	8 (SD = 3.26)	6.1 (SD = 3.49)	7.45 (SD = 3.1)	5.75 (SD = 3.4)
experimental group	8.88 (SD = 3.83)	7.19 (SD = 3.66)	8.44 (SD = 3.72)	7 (SD = 3.78)

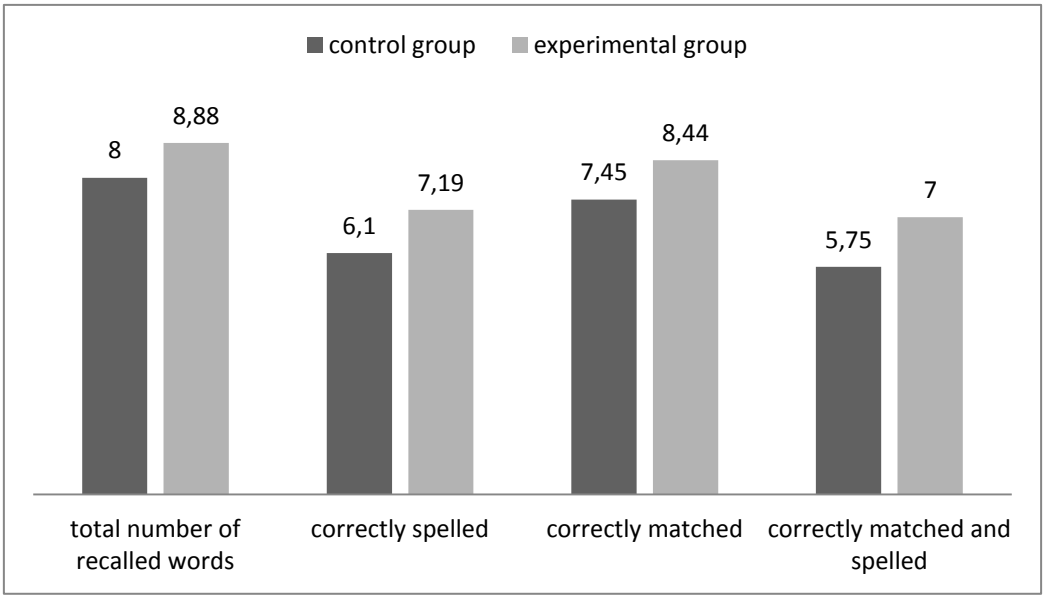


Chart 1: Average results of recalled words in total (1), with correct spelling (2), correctly matched words (3), and correctly matched and spelled words (4) for the control and experimental group.

The correlation of the test results with group membership amounted to a figure of r = 0.13 for the total number of recalled words (1) and to r = 0.15 for those words that also were correctly spelled (2). The relation for the number of correctly matched words (3) reached a figure of r = 0.15 and the words that were matched and spelled correctly yielded to r = 0.18. The data did not reach significance under any of the above described conditions (all $p>0.05$).

Due to the lack of significant data, it seems to be necessary to present the answers of the three control questions concerning the students' effort, concentration, and experience of difficulty. Averagely, participants in the control group (M = 2.65) reported a little bit more often that they had put less effort into the task of learning the vocabulary than the experimental group (M = 2.69). The control group (M = 2.5), however, also claimed that they had been more concentrated during the memorisation phase than did the experimental group (M = 2.44). The most decisive differences can be found in the answers for the third question which asked for how difficult the students experienced the retrieval of the words in the subsequent vocabulary test. Here, students in the control group (M = 2.25) reported in the mean that they had greater difficulties to reproduce the translations while students in the experimental group (M = 2.06) considered it to be easier to match the words to their respective translations.

The students' self-reported marks averagely amounted to grade 3 in the control group and to grade 2.6 in the experimental group. The calculation of the modal value revealed that the most common mark in the control group was grade 4 and grade 3 in the experimental group.

6. Discussion

Although several studies have shown a relationship between colour and behaviour, the present study did not succeed in attaining the same results. The data did not reach significance and, therefore, a connection between colour and performance in achievement contexts could not be evidenced. Although a slight tendency can be observed that the participants in the experimental group were able to retrieve approximately one word more in each category. The fact that the present study failed to replicate the findings of Mehta and Zhu (2009) and Elliot et al. (2007) does not suggest, however, that there is no connection between colour and behaviour in achievement contexts but that more research has to be conducted under slightly altered conditions.

It can first of all be assumed that the selected sample was too small to reach any significant results. Further research should include either more classes or classes that are larger in size. The comparability of students has to be retained, though. Since the present study has been conducted at a private school, all available class sizes were similarly small. The selected two classes were chosen because the comparability could be ensured by the exposure to the same content during the consolidation period. If a special arrangement between the chemistry teachers of all year ten students had been targeted, however, that determined what should be taught in the lesson of the study, the sample could have been extended. Such a strong interference with the school routine is, however, not always possible nor appreciated by the teachers.

Although the selected sample of participants was comparable in terms of age ($M_1 = 15.1$, $M_2 = 15.56$), group size ($n_1 = 20$, $n_2 = 16$), gender ($m_1 = 9$, $f_1 = 11$; $m_2 = 8$, $f_2 = 8$), and content-related exposure, it cannot be excluded that the groups were situated at different performance levels at the time of the study. Especially what the language ability in the subject English concerns, it would be beneficial in a further experiment if the two groups were also taught by the same English teacher which would raise the probability that the students in both classes had dealt with similar topics in the past, were instructed in an analogous manner and may also have reached a comparable level of language command. The present

study has contented itself with interviewing the two English teachers before conducting the study in order to ensure that the chosen words were appropriate for the students' level of language ability and not already familiar to them. The students' self-reported grades from the previous year showed that the experimental group reported to have received slightly more good grades (M_2 = 2.6) than the control group (M_1 = 3) whereas the modal value showed accordingly that the mark 4 was the prevailing mark in the control group and grade 3 in the experimental group. Since the collected data merely reflect self-reported grades and since the English teachers are two separate individuals whose assessment cannot be considered to be applicable across classes the tendency may be neglected. From the given data it cannot be concluded that the experimental group has been on a higher level of language ability at the time of the study than the control group.

For logistic reasons it was, moreover, not possible to test the two groups in two adjacent lessons. Hence, the control group was already tested in the fourth period (10.45-11.30 h), while the experimental group had their chemistry lesson not until the seventh period (13.55-14.40 h). It could, therefore, be assumed that, under different external circumstances, i.e. if they had been tested at the same time of day, the experimental group might have shown not only a tendency to recall more words but a significantly higher number. While the fourth period lies at a time of day where productivity and learning ability is assumed to be at its peak, the seventh period takes place directly after the third long break in which the students have probably eaten lunch and are less concentrated than before noon. Although similar conditions were tried to be established in both classes, it was noticeable that the experimental group was substantially more restless, "full of go", and unconcentrated. The results of the control questions confirm the experimenter's impression in showing that the experimental group in comparison to the control group reported to have been less concentrated during vocabulary acquisition. Nevertheless, they reported more often that it was easier to reproduce the words than it was for the control group and they also obtained better results. Being aware that the differences between the two groups are only small and did not reach significance it should be noted all the same that the fact that the

experimental group was less concentrated but nevertheless reproduced approximately one word more in each category could be seen as a sign that it was generally easier for them to retrieve the information. It could, thus, be suggested that the colour red might have supported the memorisation process by keeping the words in the priming memory system which enabled the students to retrieve the words more easily. Even though the experimental group's results only show a small tendency of being better, such a finding supports the results of Mehta and Zhu (2009).

A further reason why the study has not reached significance might be the maladjustment of the vocabularies' difficulty level and the time given to memorise them. In the study by Metha and Zhu (2009) only concrete nouns had to be learned within the short period of two minutes. The choice not to limit the study design to concrete nouns is quite reasonable in a school-context since it would not comply to school reality if it was proceeded otherwise. But given that it is more demanding to integrate abstract words into the semantic network, it is worth a thought if more time should be granted for the process of vocabulary acquisition. How much time was necessary would have to be determined in one or several pretests. The period of time that is determined that way yet has to remain short enough to ensure that the students still act under time pressure to induce a feeling of being under review if the phenomenon was to be researched by an external rater once more.

As a last point the achievement situation that was tried to be established in the present study has to be questioned in general. The extreme artificiality of the situation might have had a decisive impact on the students' performance. A vocabulary test that is executed by a school external person and that is unlikely to have any influence on the students' individual grades can be seen as far less threatening for a student's self-efficacy and could prevent a fear of failing from arising at all or just occur to a small extent. If the theory of Elliot et al. (2007) is called upon that would mean that the primed association with red, i.e. fear of failing, might have been counteracted by the situation in which the vocabulary test was accomplished which did not succeed in raising a high level of pressure to achieve. Although it was indeed highlighted that the test would be evaluated and

that the experimenter would give feedback on the achieved results, students were aware that the experimenter was not allowed to grade them for their performance which especially became apparent when they were not requested to write their names on the test. This problem cannot be overcome by an external rater, however.

I believe that action research is one of the only methods that could be applied to gain valid results in researching the question of the impact of red in achievement contexts in school reality. An English teacher is the expert and the only person able to decide whether two groups of learners are comparable enough to gain valid results in this specific question by altering only one variable during the learning process. Students would not only be primed by a red frame on a single occasion but the overall impact of colours on the learning process could be monitored over time. A teacher who has identified two classes that are akin in terms of their language performance could pay attention to teaching them in the same way and only alter the colour concepts employed during vocabulary acquisition, proof reading etc. The students would not have to be aware of this experiment until the teacher had gained significant results and, therefore, the authenticity of the learning process would not be jeopardised.

7. Conclusion

This paper has presented a study that sought to establish whether the exposure to the colour red helped to improve students' cognitive performance in detail-oriented tasks under achievement conditions or whether it is responsible for impairing achievement in said contexts.

In the course of providing the theoretical background for the study, it has been explained how colour associations are biologically and evolutionary determined on the one hand but also culturally induced on the other hand. It can, therefore, be assumed that the tendency to act according to specific colour concepts is, to a certain extent, innate and learned. The unconscious and automatic process that is involved has been identified as priming. It has been reported how research has revealed that red was encountered with avoidance motivation by study participants but that it is still ambiguous whether this had a positive or negative effect on the accomplishment of complex tasks.

The conduction of the experiment had been motivated by the fact that although it has been generally agreed upon by scientists that colours have an impact on the behaviour of human beings, they have yet not been able to concur whether specifically the colour red had a beneficial or detrimental effect on performance. Most probably, that is due to the different emphases that were applied during the respective studies. Thus, Elliot et al. (2007) employed IQ tests in nearly each task that put a high pressure on the test persons' self-efficacy in order to simulate an achievement context. On the other hand however, they failed to distinguish between detail- and creativity-oriented tasks. While Mehta and Zhu's (2009) main aim was to find differences between the latter two, they refrained from constructing an achievement context that would have raised the participants' fear of failure. The presented study tried to bridge the two approaches by researching students' performance in a detail-oriented task *and* in an achievement context.

Unfortunately, the conducted study did not succeed at finding a relationship between exposure to colour and performance. The collected data did not reach significance which could be attributed to external incongruities like daytime, the

students' concentration, or the artificiality of the testing situation. Since a small tendency could, however, be observed that suggests that the group that was exposed to the red prime performed a bit better although they had reported that they were not as concentrated as the control group, further research should by all means continue to investigate the impact of red. The manner in which this undertaking is to be accomplished is still to be determined, though. As has been discussed, I believe that the influence of red on vocabulary acquisition is best analysed through the conduction of action research performed by a dedicated English teacher during everyday language acquisition and not by an external experimenter.

Appendix

to capture	einfangen	**to orbit sth.**	etw. umkreisen
to establish	feststellen	**remarkable**	beachtlich, außergewöhnlich
recipe	Kochrezept	**urge**	Bedürfnis, Verlangen
appropriate	passend, angemessen	**to distinguish**	unterscheiden
substantial	erheblich, beträchtlich	**edge**	Rand, Kante
initial	anfängliche(r,s)	**to acknowledge**	zugeben
core	der Kern	**to remove**	entfernen, beseitigen
evidence	Beweis, Hinweis	**gradual**	allmählich, langsam
crucial	äußerst wichtig, entscheidend	**honesty**	Ehrlichkeit

to remove	entfernen, beseitigen	**crucial**	äußerst wichtig, entscheidend
evidence	Beweis, Hinweis	**to orbit sth.**	etw. umkreisen
initial	anfängliche(r,s)	**substantial**	erheblich, beträchtlich
to distinguish	unterscheiden	**recipe**	Kochrezept
to acknowledge	zugeben	**to establish**	feststellen
honesty	Ehrlichkeit	**remarkable**	beachtlich, außergewöhnlich
appropriate	passend, angemessen	**urge**	Bedürfnis, Verlangen
edge	Rand, Kante	**gradual**	allmählich, langsam
to capture	einfangen	**core**	der Kern

to capture:	einfangen	**to orbit sth.:**	etw. umkreisen
to establish:	feststellen	**remarkable:**	beachtlich, außergewöhnlich
recipe:	Kochrezept	**urge:**	Bedürfnis, Verlangen
appropriate:	passend, angemessen	**to distinguish:**	unterscheiden
substantial:	erheblich, beträchtlich	**edge:**	Rand, Kante
initial:	anfängliche(r,s)	**to acknowledge:**	zugeben
core:	der Kern	**to remove:**	entfernen, beseitigen
evidence:	Beweis, Hinweis	**gradual:**	allmählich, langsam
crucial:	äußerst wichtig, entscheidend	**honesty:**	Ehrlichkeit

to remove:	entfernen, beseitigen	**crucial:**	äußerst wichtig, entscheidend
evidence:	Beweis, Hinweis	**to orbit sth.:**	etw. umkreisen
initial:	anfängliche(r,s)	**substantial:**	erheblich, beträchtlich
to distinguish:	unterscheiden	**recipe:**	Kochrezept
to acknowledge:	zugeben	**to establish:**	feststellen
honesty:	Ehrlichkeit	**remarkable:**	beachtlich, außergewöhnlich
appropriate:	passend, angemessen	**urge:**	Bedürfnis, Verlangen
edge:	Rand, Kante	**gradual:**	allmählich, langsam
to capture:	einfangen	**core:**	der Kern

Vokabeltest

Bitte ergänze die englische Übersetzung.

1. Kochrezept:
2. passend, angemessen:
3. Beweis, Hinweis:
4. der Kern:
5. erheblich, beträchtlich:
6. feststellen:
7. einfangen:
8. zugeben:
9. allmählich, langsam:
10. beachtlich, außergewöhnlich:
11. entfernen, beseitigen:
12. unterscheiden:
13. Rand, Kante:
14. etw. umkreisen:
15. äußerst wichtig, entscheidend:
16. anfängliche(r,s):
17. Ehrlichkeit:
18. Bedürfnis, Verlangen:

Allgemeine Angaben

Geschlecht: □ männlich □ weiblich

Das Fach Englisch liegt mir

□ gar nicht □ eher wenig □ eher gut □ gut

Ich mag das Fach Englisch

□ gar nicht □ eher wenig □ eher mehr □ sehr

Note in Englisch im letzten Zeugnis: _____

Wie viel Mühe hast du dir bei dem Auswendiglernen der Vokabeln gegeben?

□ gar keine □ eher wenig □ eher viel □ viel

Wie konzentriert warst du während des Auswendiglernens?

□ gar nicht □ eher wenig □ eher mehr □ sehr

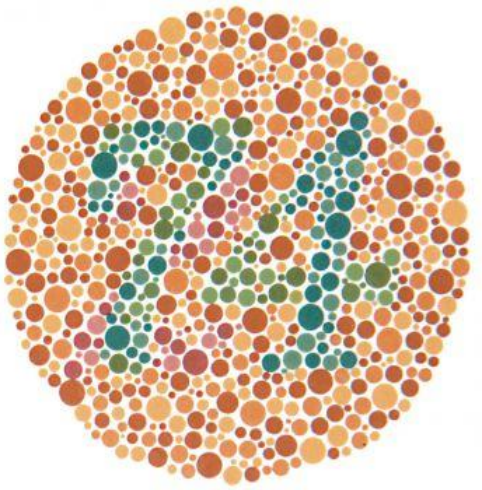
Wie leicht fiel dir das Abrufen der Vokabeln?

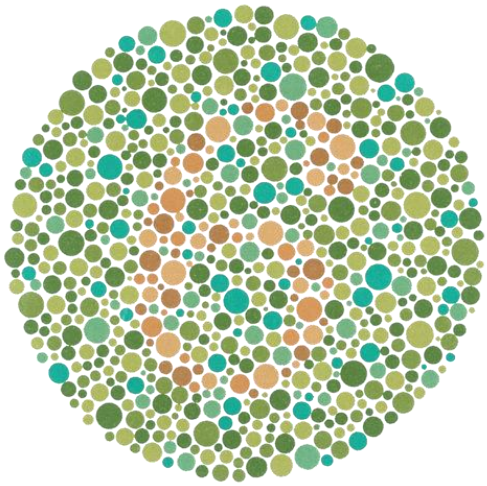
□ gar nicht □ eher wenig □ eher mehr □ sehr

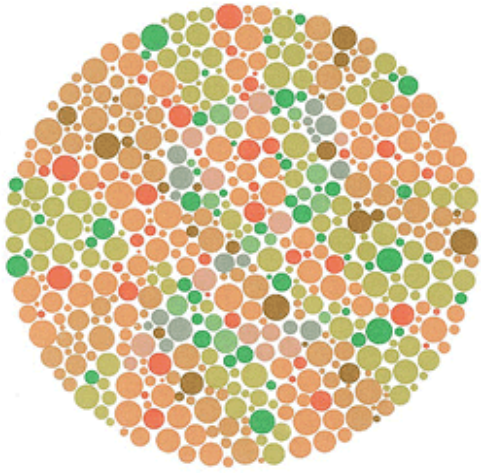
Fasse bitte nochmal kurz zusammen, worum es in dieser Studie deiner Meinung nach ging.

Danke für deine Teilnahme!

Was siehst du? Schreibe deine Antwort neben den entsprechenden Kreis.







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