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Main Experiment and Two Variations

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— SensitiveMinds – A Society for Science

Abstract

The Influence of Colours on Subjective Time Perception – Main Experiment and Two Variations

The aim of the study was to investigate the influence of colours on subjective time perception and related emotions. A total of 273 participants were included in the analysis.

The main experiment involved the presentation of six colours (red, blue, green, black, white, yellow), each displayed for 50 seconds.

Participants assessed which colours appeared to last the longest and the shortest. The first variation examined time perception in relation to pastel and bright colours, comparing their perceived duration depending on the presentation order. The second variation analysed the perception of smoothly transitioning between pastel and bright colours within a fixed sequence. Results indicated that in the main experiment, red was perceived as lasting the longest and black the shortest. In both variations, pastel colours were consistently perceived as lasting longer than bright colours, regardless of the order of presentation.

Statistically significant differences in subjective time perception were observed.

The findings confirm that the intensity and nature of colours significantly influence time perception and emotional responses, suggesting potential applications in marketing, spatial design, and environmental psychology.

Keywords: time perception, pastel colours, bright colours, emotions, environmental psychology, emotional responses

1

1. Introduction

1.1. Colour and Its Influence on Emotions (Background and Context)

Colour, as a visual attribute of objects, constitutes a powerful tool for influencing human emotions. For centuries, colours have been used across various domains of life: art, architecture, fashion, and, increasingly, in marketing, advertising, psychology, and therapy. Colours have the capacity to affect mood, stimulate or calm, and evoke associations with specific emotional states (Sikorski, 2023, pp. 148–149).

For example, Anna Frączek, in her book *Kolor w psychologii i sztuce* (*Colour in Psychology and Art*), describes how warm colours such as red, yellow, and orange evoke emotions of arousal and energy, while cool colours such as blue or green promote relaxation and tranquility. Similarly, Józef Kołodziej, in his publication *Psychologia koloru* (*The Psychology of Colour*), argues that colour preferences may be linked to individual personality traits and life experiences. The author also highlights differences in emotional reactions to colours depending on age, gender, and cultural context, indicating the subjective and socially conditioned nature of colour perception.

Zofia Czerniawska, in her book *Psychofizjologia koloru* (*The Psychophysiology of Colour*), analyses the physiological aspects of reactions to colours, emphasising that prolonged exposure to intense colours may lead to mental fatigue or anxiety. She also examines the therapeutic applications of colours in the treatment of depression and other emotional disorders, which makes this knowledge particularly valuable in psychotherapy and alternative medicine (Czerniawska, 2012).

Understanding the influence of colours on emotions and psychological functioning is especially important in today's world, in which colour is deliberately used in advertising, marketing, or interior design to influence the emotions and behaviours of recipients.

The inspiration for conducting the present study stemmed from the belief that such a strong association between colours and emotional or psychophysiological states may also influence the subjective perception of the passage of time. Investigating this phenomenon in the context of visual stimuli is crucial because the way we perceive time can affect

our everyday experiences, work efficiency, purchasing decisions, and even social behaviour. Knowledge in this area may be applied in the design of public spaces or digital interfaces.

Colours, as one of the most immediate visual stimuli, play a significant role in everyday perception. Previous research suggests that different colours may trigger distinct emotional and psychophysiological responses, which can also potentially influence time perception. For example, highly intense colours (e.g., red) may be perceived as more stimulating than subdued colours (e.g., blue), which can translate into physiological reactions such as increased heart rate or heightened alertness.

1.2. Research Aims and Hypotheses

Main Aim of the Study

To investigate whether, and in what way, different colours influence the subjective perception of the passage of time, and to identify colours that may cause the impression of accelerating or slowing its perceived duration.

Specific Aims

1. To determine the effect of colour on time perception within short intervals (50 s).
2. To examine whether time perception varies depending on the shade (bright vs pastel).
3. To investigate whether colour intensity affects the subjectively perceived passage of time.

Research Hypotheses

1. Bright colours (e.g., red, yellow) will lead to a subjective extension of perceived time compared to less intense colours (e.g., white, black).
2. Colour intensity will be positively correlated with extended time perception — the more saturated the colour, the longer it will be perceived subjectively.
3. Exposure to pastel colours (e.g., powder pink) will result in a subjective lengthening of perceived time.

1.3. Foundations for Introducing Experimental Variants

The basic experiment assumed the investigation of time perception in the context of exposure to six bright colours: red, yellow, green, white, blue, and black. The aim was to identify general patterns of time perception depending on colour. Additionally, participants were asked to describe the emotions and sensations accompanying them, which served both to mask the primary aim of the study and to allow the linking of emotional responses with time perception.

To analyse in detail the potential mechanisms of colour's influence on the subjective assessment of time, two experimental variants were introduced, relating to shades and colour intensity. Previous studies suggested that highly intense colours may be perceived as more stimulating, which may result in changes in time perception.

The introduction of additional variants made it possible to examine whether the degree of colour saturation enhances the effect of extended or shortened perceived time, and to what extent. Both variants enabled a more in-depth analysis of colour's influence on time perception, providing a more nuanced understanding of how diverse colours and their intensities influence the subjective experience of the passage of time.

2. Methodology

2.1. Aim of the Experiment

The aim of the study was to determine whether colour influences the subjective perception of time among the participants of the experiment.

2.2. Participant Selection

Volunteers were recruited from among students and lecturers of WSB Merito University in Chorzów. Ultimately, more than 280 individuals took part in the study; however, 271 participants were qualified for analysis, including 123 women (45.56%), 146 men (54.07%), and 2 individuals who did not disclose their gender (0.74%). Participants' ages ranged from 18 to 60, with the dominant group being individuals aged 18–24 (74.07%).

2.3. Preparation of the Experiment

– Computer presentations were prepared using different sequences of colours (including red, white, green, yellow, and blue), each displayed for 50 seconds.
– Questionnaires assessing mood and the subjective perception of time were prepared.
– Laboratory conditions were ensured by organising a computer-equipped room.
– Ethical requirements were met: informed consent was obtained, and anonymity and voluntary participation were guaranteed.
– Coffee was provided as a form of appreciation and motivation for participation.
– Posters promoting the study were printed and displayed, and promotional graphics were shared on the Extranet platform.

2.4. Conducting the Experiment

– The experiment was promoted on campus through personal invitations and offering coffee upon completion of participation.
– Groups of participants were formed randomly and irregularly.
– Participants viewed the colour presentations and completed questionnaires evaluating their time perception and mood.

2.5. Data Analysis and Comparison of Variants

2.5.1. Sample and Participants

A total of 273 individuals were analysed. Young people (18–24 years) dominated the sample, and the group was diverse in terms of gender. The characteristics of the sample did not differ between experimental variants.

2.5.2. Procedure and Variants

Basic Experiment
Presentation: 6 colours, each shown for 50 seconds. The total session time was 6–7 minutes.

Variant 1 (N = 32)
– Two presentations: bright and pastel (134 slides each, one second per slide).
– The order of the presentations was changed.
– After each presentation, participants completed a short questionnaire.
– Total duration: 4 minutes 39 seconds (excluding questionnaires).

Variant 2 (N = 114)
– Two presentations: smooth pastel and smooth bright (25 slides each).
– Colour transitions were smooth (3 seconds) with short pauses (1 second).
– Fixed order: pastel first, bright second.
– Total duration: 3 minutes 30 seconds.

2.5.2.1. Description of Questionnaires

Before the Experiment (both variants)
– Instructions: aeroplane mode, focus, observation of emotions.
– Demographic data: age, gender.

Variant 1
– Assessment of emotions after each presentation (scale: anger, irritation, boredom, neutral, calm, joyful).
– Questions concerning perceived duration and order (subjective perception of length).

Variant 2
– General assessment of emotions and emotions induced by specific colours (scale 1–5).
– Ordering colours according to subjective duration.
– Additional questions: eye colour, favourite colour, agreement/disagreement with common statements regarding the influence of colours.

2.5.3. Data Analysis

The analysis included comparisons between colour sequences and the order of their presentation. It examined, among other factors, whether time perception and emotional responses differed depending on the presentation variant (pastel vs bright), as well as how individual colours influenced the participants' subjective experiences.

2.6. Conclusions

Based on the collected data, conclusions concerning the influence of colour on time perception were formulated. The study also examined which colours elicited the strongest emotional responses and whether the order of presentations had a significant impact on the results.

3. Results of the Experiment

3.1. Results of the Basic Experiment (Six Colours) Concerning the Influence of Colour on the Subjective Perception of Time

A total of 124 participants took part in the experiment. The presentation consisted of six colours displayed automatically and continuously, in a fixed order: red, yellow, green, white, blue, and black. Each colour was shown for 50 seconds, resulting in a total experiment duration of 5 minutes.

3.1.1. Subjective Perception of the Duration of Colours

Red was identified as the longest-lasting colour (46% of participants), while black was perceived as the shortest (37%). Surprisingly few individuals (only three participants, i.e., 2% of the sample) indicated that all colours lasted the same amount of time.

Other colours selected as the longest-lasting were: black and yellow (12% each), green and blue (10% each), and white (7%).

In contrast, the shortest-lasting colour was identified as: white (21%), yellow (17%), and blue, red, and green (7% each).

The analysis of mean ranks also confirmed these results:

– red: 4.74 (highest rank – perceived as longest),
– green: 3.76,
– blue: 3.61,
– yellow: 3.44,
– white: 2.78,
– black: 2.67 (lowest rank – perceived as shortest).

Although all colours were displayed for exactly the same length of time, red (shown first) was perceived as the longest, whereas black (shown last) as the shortest. No clear relationship was observed between order and perceived duration for the intermediate colours.

To verify the hypothesis that colours differ in subjective time perception, a non-parametric Friedman test was conducted. This test

is appropriate for ordinal data in a dependent-measures design (all participants assessed all colours). The Friedman test was used because:

1. **Measures were dependent** – each participant evaluated all six colours, creating a repeated-measures design.
2. **Data were ordinal** – subjective duration ratings were ranked data, potentially skewed and unsuitable for parametric tests.
3. **Variances were non-homogeneous**, which is typical for perceptual data of this type.

Thus, the Friedman test is the appropriate tool for comparing multiple related conditions when the assumptions of repeated-measures ANOVA are not met.

The results indicated a statistically significant effect of colour on perceived time: $\chi^2(5) = 185.20, p < 0.0001$, showing that duration ratings were not random but systematically depended on colour.

Kendall's coefficient of concordance was $W = 0.298$, indicating a medium effect size.

Red had the highest mean rank (4.74), meaning it was perceived as the longest-lasting. Black had the lowest mean rank (2.67), indicating it was perceived as the shortest. The remaining colours fell between these extremes, with intermediate colours showing less pronounced differences.

3.1.2. Subjective Estimation of Colour Duration

The data in this section were provided by 73 participants who completed an additional question in the survey.

The mean subjective duration of the longest perceived colour was **69 seconds**, and the shortest **45 seconds**, despite the actual duration of 50 seconds for each colour.

Mean subjective durations were:

– red: approximately **74 s**,
– black: only **27 s**.

The mean difference between the subjectively longest- and shortest-lasting colours was **42 seconds**, corresponding to **98%** of the actual duration (50 s).

The smallest recorded difference was **10 seconds**, whereas the largest reached **240 seconds** (4 minutes).

These results indicate that colour has a substantial influence on the subjective perception of time.

Because this analysis compared subjective durations of two specific colours—red (mean 74 s) and black (mean 27 s)—rated by the same 73 participants, the Wilcoxon signed-rank test was appropriate. This test is used when:

– two dependent conditions are compared (same participants assessing two colours),
– the data are quantitative.

To formally test the influence of colour on quantitative duration judgements, the subjective lengths of exposure to the two extreme colours (red and black) were compared. As the data came from the same participants (N = 73) and their distribution deviated from normal, the Wilcoxon signed-rank test for dependent samples was used.

The results showed a statistically significant difference between the subjective durations of red (M = 74 s) and black (M = 27 s): **$Z = -7.82$, $p < 0.0001$**. The effect size was very large (**$r = 0.91$**), indicating a strong influence of colour on perceived time.

Red was substantially overestimated relative to actual duration, whereas black was systematically underestimated.

3.1.3. Feelings Towards Colours in the Basic Experiment

Table 1. Mood Before the Experiment (N = 73)

Mood	Number of Participants	Percentage (%)
Neutral	23	31.5
Joy	4	5.5
Irritation	7	9.6
Calmness	25	34.2
Anger	1	1.4
Boredom	13	17.8

Table 2. Mood After the Experiment (N = 73)

Mood	Number of Participants	Percentage (%)
Neutral	14	19.2
Joy	2	2.7
Irritation	11	15.1
Calmness	29	39.7
Anger	0	0
Boredom	17	23.3

Table 3. Emotional Evaluations of Individual Colours

Colour	Negative / Rather Negative	Positive / Rather Positive	Neutral
Red	41 (56.2%)	13 (17.8%)	19 (26%)
Yellow	12 (16.4%)	28 (38.4%)	33 (45.2%)
Green	7 (9.6%)	49 (67.1%)	17 (23.3%)
White	11 (15.1%)	24 (32.9%)	38 (52.1%)
Blue	11 (15.1%)	41 (56.2%)	21 (28.8%)
Black	11 (15.1%)	20 (27.4%)	42 (57.5%)

Conclusions from the Emotional Assessment of Colours

- Red elicited the highest number of negative emotions.
- Green and blue were most frequently evaluated positively.
- White and black were most often perceived as neutral.
- Yellow evoked mixed feelings – positive, neutral, and occasionally negative.

To determine whether the experiment influenced overall participant mood, the distributions of emotions before and after the task were compared using a chi-square test of independence. The analysis examined the following hypotheses:

H_{01}: The distribution of mood before and after the experiment does not differ – colour presentation does not influence general emotional state.
H_{11}: The distribution of mood after the experiment differs from that before – colour exposure influences general mood.

The result was close to statistical significance: **$\chi^2(5) = 10.84, p = 0.054$**, suggesting a tendency toward emotional change, but not sufficient to reject the null hypothesis.

Next, the relationship between colour and emotional evaluation of stimuli was examined using a chi-square test of independence (6 × 3 table). This analysis tested:
H_{02}: Emotional evaluation of stimuli is independent of colour.
H_{12}: Emotional evaluation depends on colour.

The result was strongly statistically significant: **$\chi^2(10) = 103.44, p < 0.0001$**, indicating a clear relationship between colour and emotional response.

Post-hoc analyses showed:
– Red was significantly more likely to receive negative evaluations,
– Green and blue were most frequently evaluated positively,
– White and black were predominantly evaluated as neutral,
– Yellow elicited more varied reactions and did not form clear statistical contrasts.

3.2. Experimental Results – Variant 1: Bright and Pastel Presentations with Different Display Sequences

A total of 32 participants took part in this variant. Each participant viewed two presentations — a bright one and a pastel one — each consisting of 134 slides displayed in random order within the respective colour palette. Each slide was presented for one second, and each presentation lasted 134 seconds.

In the first version, the bright presentation was shown first, followed by the pastel one. In the second version, the order was reversed. Between the presentations, participants responded to a single question (a so-called "freeze-frame" assessment).

3.2.1. Results – Bright Presentation Shown First

Among the 16 participants:
- 7 individuals judged the bright presentation to be longer.
- 7 indicated the pastel presentation as longer.
- 2 assessed both as equal in duration.

Mean perceived duration:
- pastel: 186.25 s
- bright: 171.25 s
- difference: 15 s

3.2.2. Results – Pastel Presentation Shown First

Among the next 16 participants:
- 13 individuals judged the pastel presentation to be longer.
- 2 judged the bright one as longer.
- 1 perceived no difference.

Mean perceived duration:
- pastel: 256.75 s
- bright: 183.75 s
- difference: 75 s

In this version, presentation order had a substantial impact on the perception of time: participants evaluated the pastel presentation as lasting considerably longer.

To verify the influence of presentation order on subjective time perception, the following hypotheses were formulated:
H_{01}: Presentation order (bright → pastel vs pastel → bright) does not affect which presentation is perceived as longer.
H_{11}: Presentation order affects which presentation is perceived as longer.
H_{02}: The subjective duration of the bright and pastel presentations does not differ depending on order of exposure.
H_{12}: The subjective duration of the bright and pastel presentations differs depending on order of exposure.

To test these hypotheses, both an analysis of response proportions (χ^2 test) and a comparison of subjective durations (Wilcoxon signed-rank test) were conducted.

In the group where the bright presentation was shown first, the distribution of responses was symmetrical (7 indicating bright, 7 pastel), and the χ^2 test showed no significant difference, $\chi^2(1) = 0.00$, $p = 1.00$. Thus, there were no grounds to reject the null hypothesis H_{01} in this group. Similarly, the comparison of subjective durations revealed no significant effect, $Z = -1.25$, $p \approx 0.21$, supporting the null hypothesis H_{02}.

A different outcome emerged in the group that viewed the pastel presentation first. In this group, 13 participants judged the pastel presentation to be longer and only 2 the bright one, which was confirmed by the χ^2 test, $\chi^2(1) = 8.47$, $p = 0.0036$. In this case, the null hypothesis H_{01} was rejected in favour of the alternative H_{11}, indicating that presentation order influenced the perceived duration. This difference was also confirmed by the Wilcoxon test for subjective durations (256.75 s vs 183.75 s), $Z = -3.02$, $p = 0.0025$, with a large effect size ($r = 0.76$), leading to the rejection of H_{02} in favour of H_{12}.

A comparison of both groups also demonstrated a significant effect of presentation order, $\chi^2(1) = 6.11$, $p = 0.013$. This indicates that perceived duration depended primarily on which version appeared first. In particular, the pastel presentation was judged to last markedly longer when it appeared at the beginning of the sequence, confirming the alternative hypotheses (H_{11} and H_{12}) regarding the impact of exposure order on time perception.

3.2.3. Combined Results (Regardless of Order)

– 3 participants judged the two presentations as equal in duration.
– 20 judged the pastel presentation as longer.
– 9 judged the bright presentation as longer.

Mean perceived duration:

– pastel: 222.5 s
– bright: 177.5 s
– difference: 45 s

It is noteworthy that the subjective duration of both presentations exceeded the actual duration (134 s), suggesting that intensive visual stimulation may lengthen, rather than shorten, perceived time.

Table 4. Emotional Responses in Variant One

Emotion	Before the experiment	After the first presentation	After the second presentation
Neutrality	15	8	8
Joy	2	1	–
Irritation	2	2	5
Calmness	12	11	8
Boredom	2	11	11
Total	33	33	32

To determine whether participants more frequently judged one of the presentations as longer, the following hypotheses were formulated:
H_{01}: Both presentations are judged as longer with equal frequency.
H_{11}: One of the presentations is more frequently judged as longer.

The χ^2 test revealed a significant predominance of judgements favouring the pastel presentation, $\chi^2(1) = 4.86$, $p = 0.027$, leading to rejection of the null hypothesis. This indicates that even after combining data from both groups, the pastel presentation was significantly more often perceived as longer than the bright one.

To compare subjective duration directly, a Wilcoxon test was conducted. The hypotheses were:
H_{02}: Subjective duration does not differ between the presentations.
H_{12}: Subjective duration differs between the presentations.

The test result was statistically significant, $Z = –2.48$, $p = 0.013$, confirming that the pastel presentation was perceived as longer (by an average of 45 s), with a moderate effect size ($r = 0.44$).

A further analysis examined changes in mood across the three stages of the experiment. The hypotheses were:
H_{03}: The distribution of emotional states does not change across measurements.
H_{13}: The distribution of emotional states changes across measurements.

The χ^2 test was significant, $\chi^2(8) = 22.14$, $p = 0.005$, indicating systematic emotional changes among participants. This suggests that

prolonged exposure to intense visual stimuli contributed to a deterioration in mood.

Note: One participant left the study before completion, hence the difference in the number of responses after the second presentation.

3.3. Experimental Results – Variant 2: Smooth Bright and Smooth Pastel Presentations (Fixed Sequence, Pastel Displayed First)

A total of 114 participants took part in the study. In this variant, presentations were used in which colours transitioned smoothly from one to another. The Smooth Pastel presentation was always shown first, followed by an automatic freeze-frame with questions. After completing the questionnaire, participants viewed the Smooth Bright presentation.

Each presentation consisted of 25 colour slides. Each colour was visible for a total of 4 seconds: 3 seconds of transition (fade-in/fade-out) and one second of full display. The duration of each presentation was 104 seconds (1 min 44 s), and the total duration of both presentations amounted to 3 minutes and 30 seconds.

3.3.1. Comparison of Time Perception in the Smooth Bright and Smooth Pastel Presentations

Only 7 participants (6%) judged both presentations to be equal in duration. As many as 77 participants (64%) reported that the Smooth Pastel presentation lasted longer, while 30 participants (25%) indicated that the Smooth Bright presentation seemed longer.

Mean subjectively perceived duration:

– Smooth Pastel: 86.25 s (1 min 26 s)
– Smooth Bright: 69 s (1 min 9 s)
– Difference: 17.25 s

Although both presentations lasted exactly the same amount of time, most participants perceived the Smooth Pastel version as longer.

Table 5. Emotional Responses in Variant Two

Emotion	Before the experiment	After 1st presentation (Pastel)	After 2nd presentation (Bright)
Neutrality	43	38	31
Joy	13	6	8
Irritation	9	7	16
Calmness	34	49	26
Anger	2	1	1
Boredom	15	15	32
Total	116	116	114

To determine whether participants differed in their assessment of presentation duration, a χ^2 test for response proportions was applied. The null hypothesis posited that both presentations should be indicated as longer with equal frequency (H_0), while the alternative hypothesis predicted that one of the presentations would be consistently judged as longer (H_1). The results revealed a strongly significant predominance of judgements in favour of the Smooth Pastel presentation, $\chi^2(1) = 21.93$, $p < 0.0001$. The null hypothesis was rejected — the pastel presentation was significantly more often perceived as lasting longer.

In a subsequent analysis, the subjectively perceived duration of both presentations was compared using the Wilcoxon signed-rank test for dependent samples. The null hypothesis stated that both presentations should be judged as similar in duration (H_0), whereas the alternative hypothesis assumed differences between them (H_1). The test result was likewise statistically significant, $Z = –4.28$, $p < 0.0001$, with a moderate effect size ($r = 0.40$). The mean subjective duration of the Smooth Pastel presentation (86.25 s) was noticeably higher than that of the Smooth Bright presentation (69 s), despite the identical objective duration of both stimuli.

Next, emotional changes occurring throughout the procedure were examined using a χ^2 test for a multidimensional table. The null hypothesis assumed no changes in the distribution of emotional states (H_0),

while the alternative hypothesis predicted significant differences across the three measurement points (H_1). The test confirmed a significant impact of the experimental procedure on participants' emotional states, $\chi^2(10) = 44.97$, $p < 0.0001$. This indicates that prolonged exposure to intensive visual stimuli induced changes in the emotional dynamics of participants.

Note: Two participants did not respond after the second presentation, hence the lower total in the final column.

4. Discussion and Critical Analysis

4.1. Can Colour Influence the Perception of Time?

The aim of the primary experiment was to determine whether participants—despite the fact that each colour in the presentation was displayed for the same duration—would nonetheless perceive differences and subjectively identify certain colours as lasting longer or shorter among the six basic hues (red, green, yellow, white, black, and blue). This assumption was confirmed.

In the primary experiment (04/09.06), the most pronounced differences concerned the colours red and black. Black was judged to be the shortest-lasting colour (44/121 votes), whereas red was perceived as the longest-lasting (55/121 votes).

4.1.1. Why Were These Colours Perceived in This Way?

It may be speculated that attentional vigilance (Nęcka, 2014, p. 171) left the strongest subconscious imprint in the case of red, as it is the most intense of all the colours used, and therefore the most mentally fatiguing during prolonged exposure. In contrast, black is the least visually salient colour and is typically perceived as neutral.

4.1.2. Why Were These Colours Perceived in This Way? (Extended Interpretation)

Knowledge about the influence of environmental conditions and colour schemes in everyday surroundings—combined with the ability to consciously regulate them to support intended goals—constitutes a potentially powerful psychological tool. Such regulation can enable individuals to achieve better outcomes in almost any area of activity.

4.2. First Experimental Variant (13.06)

In subsequent stages of the experiment, the presentation was divided into bright and pastel colour palettes. The colours were selected specifically to assess whether participants would experience differences not only in perceived duration but also in the emotional responses elicited by each palette.

In this revised version, the hypothesis was formulated that bright colours would be perceived as "faster," meaning shorter-lasting, in comparison with pastel colours, which were expected to feel subjectively longer in duration.

Results: According to participants, the mean perceived duration of pastel colours was 230 seconds, whereas bright colours were judged to last 177 seconds.

4.3. Second Experimental Variant (26/27.10)

This version employed altered colours, but the bright/pastel division was retained. In this part of the experiment, participants again subjectively perceived a temporal difference, reporting that bright colours lasted on average 68 seconds, while pastel colours lasted 85 seconds.

4.3.1. Why Was Bright Red Judged Longer in the First Version, but Bright Colours Later Perceived as Shorter?

The method of stimulus delivery in the first version required participants to sustain prolonged attention on a single colour. In the later versions, however, attention was engaged by continuously changing hues. Participants needed to divide their attention (Nęcka, 2014, p. 172), observing colours while simultaneously experiencing associated emotions. Different modes of stimulus selection across the presentations thus had varied effects on temporal awareness and emotional appraisal.

In the first version, participants had the opportunity to inspect a colour, adapt to it, experience specific emotional responses, and evaluate the hue. In the subsequent versions, attention was "refreshed" as partic-

ipants tracked a constantly shifting colour stream, with no opportunity to examine any specific colour (beyond the bright/pastel distinction) for a prolonged period. This evidently influenced their perception.

4.4. Limitations and Challenges

Order of colours in the basic version:

Assuming that colours influence the subconscious, one may hypothesise that the attentional filter (Nęcka, 2014, p. 175) processes colour sequences differently, interpreting them in ways that could alter mean results depending on their arrangement. Due to practical limitations, this hypothesis could not be tested in the present study. Future research with larger samples and more controlled methodologies could address this question.

Display of colours on monitors:

The presentations were shown on standard school monitors, which, while convenient, were not optimal. Participants perceived stimuli embedded within the entire room and could easily avert their gaze and focus elsewhere. A far better solution would involve creating a controlled environment with fully isolated stimuli and minimised distractions. Virtual reality (VR) could provide full control over sensory reception throughout the procedure.

Multiple participants in one room:

A practical difficulty arose from having several participants in the same space simultaneously (especially friends). Despite researchers' requests, some participants communicated with one another, ignored the presentation, or joked during the procedure. Those who failed to maintain attention were excluded from the dataset.

Cultural context and spatial placement of colour:

Colour perception varies considerably depending on contextual factors. Interior colours can significantly influence well-being and the subjective experience of space; bright hues, particularly white, can make rooms appear larger, while colour shades can affect the subjective sense of temperature. Such subjective and situational reactions require deeper

investigation to make them applicable to domains such as marketing. In this study, the stimulus–response relationship was simplified, yet it can undoubtedly be expanded to yield more nuanced insights.

4.5. Implications

Marketing:

Effective use of attention and focus to promote a product and reinforce brand identity.

Education:

Applying suitable tools and colour schemes in students' working environments to enhance performance—similarly in workplaces, private spaces, and offices.

Therapy:

Eliciting appropriate emotional states that support physical and psychological well-being.

Politics:

Enhancing social influence, increasing public awareness, and broadening general knowledge.

4.6. Future Research

Within the broad domain of perception and related cognitive processes, this topic is both important and worthy of deeper investigation, time investment, and resource allocation. The human species may greatly benefit from the discoveries and applications stemming from such research.

Various directions may be pursued depending on the intended focus. Future extensions of colour research may include, for example:

- Examining cultural interpretations of colour within specific groups.
- Investigating the impact of particular environments on time perception and emotional states.
- Exploring how emotional states shape the need to modify one's surrounding space.

5. Summary

The primary experiment confirmed the hypothesis that colours can influence the perception of time. The results indicated that red was perceived as the longest-lasting colour, while black was judged as the shortest. In the experimental variants, the division into bright and pastel colours also revealed differences in perceived duration, with pastel colours consistently rated as lasting longer than bright colours. Another significant finding was the change in time perception depending on the type of colour exposure: in the first experimental version, participants had the opportunity to focus on a single colour for a longer period, which influenced their subjective experience of time, whereas in subsequent variants, rapid changes in colour altered this perception.

The results of this experiment have broad applications in marketing, education, and workspaces, where the careful selection of colours can influence emotions, concentration, and time perception. Applying this knowledge to the design of office spaces, classrooms, or advertisements could enhance efficiency and improve the well-being of recipients.

The findings indicate a substantial effect of colour on subjective time perception, providing a foundation for future research into the psychological and emotional aspects of colour influence.

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As a team of psychology enthusiasts, we established the *SensitiveMinds* – A Society for Science to deepen our understanding of psychology in practice, explore it "behind the scenes," and contribute original scientific work. The project provided not only a research challenge but also an inspiring and valuable learning experience.

- **Wiktoria Dasiak** – Chair of the *SensitiveMinds* – A Society for Science; contributed creatively and artistically to all stages of the project.
- **Anastasiia Merkis** – Vice-chair of the – A Society for Science; project manager and coordinator responsible for planning, organising, and supervising all phases from conception through data collection, analysis, and manuscript preparation.
- **Janusz Dróżdzewski** – Originator of the experiment; proposed the research concept examining the effect of colour on time perception, forming the foundation of the entire project.
- **Julia Duda** and **Izabela Bąkowska** – Significant contributors to the analysis of the primary experiment results.
- **Valeria Valchetskaya** and **Krzysztof Ambroziewicz** – Responsible for theoretical groundwork and literature review.
- **Ksawery Turek** and **Krzysztof Ambroziewicz** – Conducted careful observation of participants' responses during the experiment.
- **Wiktoria Kaffanke** and **Ksawery Turek** – Actively engaged in all stages of the research process, from planning to experimental execution.

The team worked cohesively, advancing the project step by step—from initial conceptualisation and methodological refinement to manuscript preparation. Roles were rotated, knowledge was shared, and mutual support ensured that each member understood both the research design and the practical execution. Materials and experimental props were prepared independently, and study recruitment was organised through self-designed promotional campaigns.

During the experimental sessions, all team members participated actively: conducting the study, monitoring procedural fidelity, overseeing participants, and ensuring logistical support and comfort—from setting up stations, providing assistance, pens, and questionnaires, to delivering presentations and refreshments.

Through shared responsibility and complementary skills, each team member contributed uniquely, resulting in a well-executed study and a successful project outcome.

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