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Original Contribution

A MODEL OF PROGRAMMING APPROACH FOR DETERMINING THE BIG FIVE PERSONALITY TRAITS THROUGH COLOR PREFERENCES

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ABSTRACT: *Determining human behavior in a number of cases is an important, even primary, step that sets specific frameworks and guidelines for planning, constructing, and operating a wide range of structures whose focus is the human being. Based on the widely accepted theory of the Big Five Personality Traits (BFPT) and examining the existing methods used in the procedures of this theory, a set of key indicators could be derived. In the search for a scientifically proven connection between an individual's color preferences and the predefined indicators from the BFPT, a problem arises regarding the use of methods and approaches in these procedures. In most cases, the approaches rely on the use of printed materials, which, first, limit the color spectrum, second, require a significant amount of time for preparing laboratory setups, third, lack a high degree of precision, and fourth, have limited use of mathematical tools when defining color tasks for a given individual.*

KEY WORDS: *Human Color preferences, Big Five Personality Traits, Program Models, Algorithm.*

1. Introduction

In the search for a correlation between the behavior of a given biological species and color stimuli, the theory of color and its subclass concerning human behavior are formed. When examining the general conceptualization in the theory of color, some researchers propose a set of assumptions that are not numerically defined, which in turn rejects the position for accuracy in the hypothesis in specific contexts. The need for a theoretical framework emerges,

through which validity can be achieved in establishing the links between color and psychological functioning of humans in specific contexts [1].

In some scientific circles, the thesis is established regarding the initial level of development of the theoretical segment studying the relationship between color, human perception, cognitive ability, and psychological functioning, that is, behavior [1][2][3][4][5][7]. As a result of this initial level, limitations in scope are identified concerning the range of shades, the spectrum of color properties, and the direction of their influence on human behavior [1].

On the path of searching for modern methods for assessing human cognitive abilities through computational systems, certain technological approaches are being found [6][8][9].

A key part of the study of the relationship between the colors perceived by humans, determined by their properties, and one's cognitive level and psychologically defined behavior is the theoretical framework of the Big Five Personality Traits [6][9].

It is reasonable to consider the Big Five Personality Traits framework as proof model for recognizing personality [6][10]. Based on the theoretical framework in the BFPT and the assumption of a stable relationship between human personality traits and preferred color, defined by its properties, a programming model for investigating this correlation will be discussed and synthesized. From an engineering perspective, and without considering the psychological aspects of this framework, the main principles for building a programming model will be outlined in the main section.

2. Related work

In the field of studying the correlation between the Big Five Personality Traits and human color preferences, certain findings could be summarized [6][9][10][11]. The key human traits encompassed in that framework are:

- openness to experience;
- conscientiousness;
- extraversion;
- agreeableness;
- neuroticism.

The following component with conclusions from existing studies on the correlation between preferred color (properties) and personality traits of the individual can be described by the following characteristics [10][11]:

- The color can be objectified through shapes and words;
- Verbalization is used as a method of inquiry;
- Existing non-contemporary subfields of research (Stroop task, Lüscher color test) are used, whose procedures are based on text-based tasks;

- The materials used for the experiments are dominated by physical media (paper);
- In case of a digital approach, static images are used;
- Individual adjustment of the HSL color space properties (Hue, Saturation, and Lightness) was not utilized in the current approach;
- The color, represented by its properties, holds one of the key positions in this process.

The following should be stated: this publication is based on the understanding that color preferences, emotions, and personality traits of an individual are interrelated, with a focus on the thesis that the properties of color serve as a key factor in the process associated with identifying these personality traits [5][6][8][12].

3. Main thesis

As pointed out in [13], the Commission Internationale de l'Eclairage (CIE) has adopted a color system, that has proven to be successful for defining colour specification. This CIE system could be used for colour measurement across a wide range of applications. It is worth mentioning that each set of CIEs tristimulus values are related only to the single color [13].

There is use of L * C * h° subsystem of CIE system for measuring psychometric attributes corelating perceptual attributes such as lightness, chroma and hue[6][13]. There is acknowledgment of the existence of a general pattern of personal color preferences. Such preferences are commonly relying on hue, chroma and brightness.

Since the application development requires the use of the RGB color system, the most straightforward approach is to select the HSL color model as an intermediate step. A mathematically permissible transformation from the L*C*h° system to the HSL could provide a structure based on hue, saturation, and lightness, which makes it suitable for implementation. The conversion from HSL to RGB is then applied to complete the process.

From an engineering perspective, and without considering the psychological aspects in details of the framework described above, the main principles for building a programming model that achieves the following will be outlined:

- Numerical indicators are introduced for each property of the color;
- The accepted color space is HSL color space;
- Key properties of color are Hue, Saturation and Lightness;
- The set of personality traits for evaluation will be formed ("*openness to experience*", "*conscientiousness*", "*extraversion*", "*agreeableness*", "*neuroticism*");
- Option for timing will be included;

- The subject of the self-evaluation must be able to choose from a range of colors;
- The result of the current evaluation is under only to examiner's privilege;
- The final result of the evaluation is accessible to the examiner and the subject of the self-evaluation;
- There should be no limitation of the self-evaluation attempts;
- The programing technology used must require common client agent environment;
- The colorization of the spots will be used as the main stimulus object;
- The correct shape of the color spots will be used;
- The white background will be used for the colorization.

Following good development practices, the conceptualization of the model is presented in fig.1.

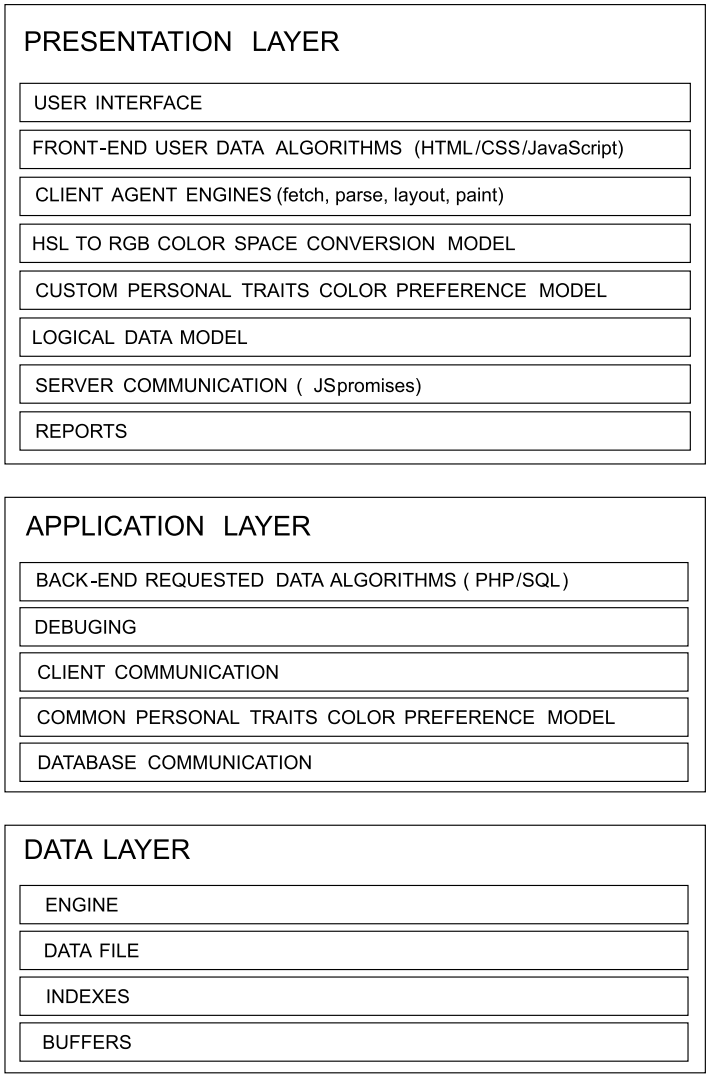

Fig. 1. Conceptual model of the application

As long as conceptualization has already been completed the architecture of the model needs to be built. In accordance with the exposed principles above, based on conceptual model, and to achieve the main development goal, an architecture model was synthesized (Fig.2). The architecture relies on three key factors: the client-server model, a web-based approach and dynamic pixel colorization.

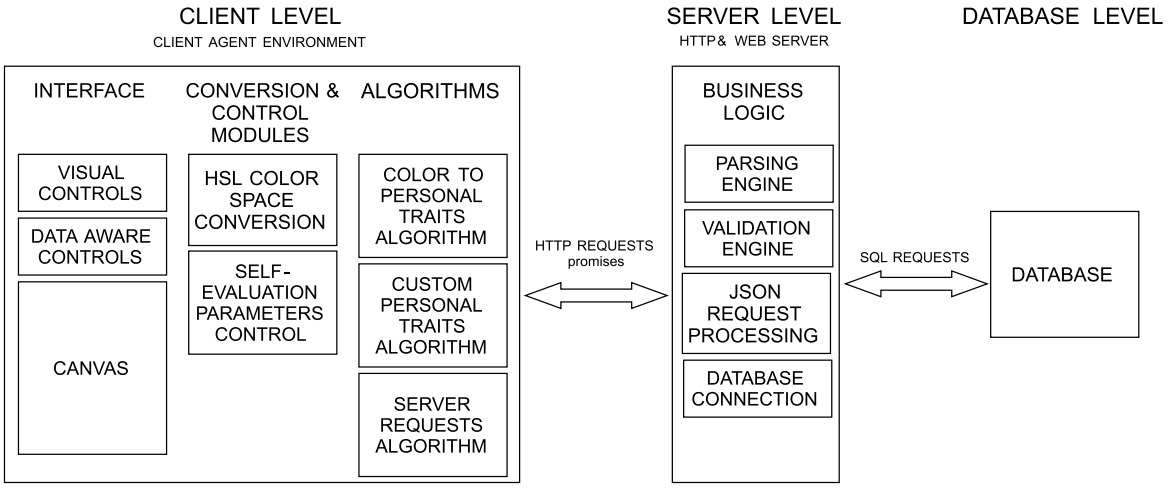

Fig. 2. Architecture model of the application

In line with the conceptual model and system architecture, the application's program structure will utilize the DOM standard [16] for constructing its internal logic. The HTML <canvas> component will be used to display color stimuli under controlled conditions, aiming to affect the visual perception of the object. A basic data model of preferred colors (table 1) has been formed based on studies examining the influence of color on the individual traits of the BFPT, presenting a link between color preferences and BFPT [1][3][6][7][12][14]. This color data model is intended solely for experimental purposes as a starting point, and does not aim to support any claim of general acceptance.

Table 1 A basic data model of preferred colors, presenting a link between color preferences and BFPT

Personality trait	Color preferences	Bundle of colors
Openness to Experience	**Bright and saturated colors** (e.g., blue, purple, green)	35% blue, 25% green, 20% purple, 20% other
Conscientiousness	**Earth-toned and calming colors** (e.g., brown, dark blue, green)	40% dark blue, 30% brown, 20% green, 10% other
Extraversion	**Vivid and stimulating colors** (e.g., red, yellow, orange)	40% red, 30% yellow, 20% orange, 10% other
Agreeableness	**Soft and pastel hues** (e.g., light blue, pink, light green)	45% light blue, 35% pink, 15% light green, 5% other
Neuroticism	**Dark and intense colors** (e.g., black, grey, dark red)	30% black, 25% gray, 20% dark red, 25% other

In the application logic, the set of key functionalities of the above model has been formed as follow:

- The examiner has the ability to customize the data in the data model of preferred colors via JavaScript algorithm;
- The examiner has the ability to adjust the threshold used in color pixel processing;
- The entire <canvas> area is subject to pixel-processing-level;
- The object of the self-evaluation should use a pointing device as a colorizing tool in <canvas> element.

There are certain restrictions defined as follow:

- The background color of the <canvas> element is set by RGB #ffffff;
- The <canvas> element should have at least 800x800 resolution;
- Implementation of an HSL color wheel with colors converted to the LCH (CIE L*C*h) model, which is better suited for human color perception.
- The threshold parameter specifies the maximum acceptable distance between two HSL color values, determining whether a pixel belongs to the predefined set of "allowed" colors for a given personality type
- The threshold range is [0-1];
- HSL-to-RGB conversion should be performed for pixel colorization within the <canvas> element;
- The color distance should be scalar.

Color distance should serve as a key measurable criterion for identifying the affiliation with a particular personality trait. The metric is grounded in the theory of directional statistics [15].

$$HSL_1 = (H_1, S_1, L_1), HSL_2 = (H_2, S_2, L_2)$$

where:
H – Hue (0–360°)
S – Saturation (0–100%)
L – Lightness (0–100%)

A circular distance has been defined by:

$$\Delta H = \frac{\min\left(|H_1 - H_2|, 360 - |H_1 - H_2|\right)}{180}$$

For S and L, the following formulae has been applied:

$$\Delta S = \frac{S_1 - S_2}{100}, \Delta L = \frac{L_1 - L_2}{100}$$

Then the color distance has been calculated as Euclidean distance:

$$distance(HSL_1, HSL_2) = \sqrt{(\Delta H)^2 + (\Delta S)^2 + (\Delta L)^2}$$

In conclusion, a color is considered to fall within the range of a given color group if the calculated distance is less than the defined threshold. The threshold controls sensitivity: lower values yield stricter matches, whereas higher values tolerate greater deviations.

4. Conclusion

Based on the synthesized conceptual and architectural models, a web-based application will be developed. This application will be deployed on a server platform, where a database containing the basic tabular components will also be established. An interdisciplinary team involving experts in the field of psychology will be formed to assist in the planning, organization, and execution of the experiments with the application. Once a critical mass of empirical data has been collected, it will be subjected to statistical analysis. If necessary, certain functionalities or components of the application may be revised accordingly.

Acknowledgments

This publication outlines the initial phase of a multi-stage research project focused on establishing a more effective methodology for investigating the influence of color preferences on personality traits.

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