EFFECTS OF OPEN CAPTION TELOP COLOR ON NEWS VALUE PERCEPTION IN THE SPECIFIC CONTEXT

Abstract

Color not only has aesthetic significance, e.g., an object may be produced in various color versions to meet different needs or personal preferences, but also has the practical significance, e.g., the traffic lights are placed at interactions to indicate the traffic, or the red and green candlesticks are used to indicate the change of stock price in the stock market. In this research, the effects of OCT (Open Caption TELOP) color on the news value perception were explored in the specific context, i.e., the perceptions of the news importance, news novelty and news timeliness were clarified through the OCT color manipulation in the emotional and application context. According to the theme, this research is consisted of several experiments, including the perception of news value on the color OCT pattern alone, on the OCT hue and tone in the emotional context, and in the media application context. Generally, OCT that can be considered as a designed subtitle is employed to indicate the news information that the news editor intends to convey. Within the study, two specific contexts, i.e., the emotional context and the application context which correspond with the news practice, were elaborated as the factors to explore the color effects. The methodology of this research consists of the following parts, i.e., the stimulus, participants and apparatus, procedure. The stimuli consists of nine colors (Chapter 2-5) for OCT, including eight chromatic hues (four primary hues and four intermediate hues), and one achromatic hue, with three tones (bright, vivid, and deep) which were selected from the PCCS color system (hue ring & tone chart); an OCT pattern (Chapter 2-5, reference to the actual usage); three news images (Chapter 3 & 4) that were selected based on its negative, neutral, or positive emotional tendencies, as well as the application scenes, i.e., the broadcast and social media (Chapter 5). Within all experimental sessions, a total of 110 participants were recruited, including 60 males and 50 females. All of them had normal or corrected-to-normal visual acuity and color vision. The apparatus mainly included different sized LED monitors, which was varied according to the session of the experiments. The specific specification of these monitors can be found in the method. Concerning the procedure, it varied according to the experimental sessions. The experimental measurements are the semantic difference method (Chapter 2-4) and the measurement of reaction time / correct response rate (Chapter 5). Regarding the results, the color effect was clarified by ANOVA, in which significant differences were observed on the

conditions that were composed of the color factors, i.e., the hue and tone, as well as the emotional and application context. For example, the OCT pattern colored by primary hue, e.g., the bright-toned yellow, vivid-toned red, and deep-toned blue can make the news perceived more important than other conditions (Chapter 2). The OCT colored by blue series hues, i.e., blue and LB/BG in all emotional news contexts may inhibit the news novelty perception (Chapter 3). The bright-toned orange OCT was superior to the same tone purple OCT on the perception of news timeliness (Chapter 4). A significant difference was observed on the news importance perception in the LB/BG OCT among the three tones in the social media (SM) context, while there was no difference observed in the broadcast (BC) context in this condition (Chapter 5). Besides, in this research, an OCT color solution plan especially for the realization of news novelty was systematically proposed. Moreover, the results of the correlation test reveal that the most chromatic hues and corresponding tones can integrate the news value dimensions simultaneously in the specific context. Each chapter was followed by a discussion. In summary, OCT processed by color can significantly affect the perception of news value in the specific context. Based on the findings, it can be broadly discussed as follows. First, the cognitive effects brought about by OCT color processing are context-dependent, i.e., although OCT was processed with the same color condition, the perceptions of the same news value dimension varied in different emotional and application contexts. Then, the physical properties of color, i.e., the hue and tone (lightness and saturation), are related to the perception of news value in varying degrees. Finally, the cognitive effect of color processing on OCT is also correlated to some extent with the cultural attributes such as color-orthodox consciousness inherent to the viewer, i.e., the participants in this research. Chapter 6 as the last chapter is a general conclusion for the whole research. Within it, the practical significance of the selected theme was explained; the research methods in the thesis were summarized; the experimental results were reviewed; the room for improvement especially in the part of methods was mentioned. Concerning future research, the designs of OCT and other issues have been prospected.

CONTENTS

CHAPTER 1

| INTRODUCTION

1.1 | Research purpose

Color not only has aesthetic significance, e.g., an object may be produced in various color versions to meet different needs or personal preferences, but also has the practical significance, such as the traffic lights are placed at intersections to indicate the traffic, or the red and green candlesticks are used to indicate the change of stock price in the stock market. There is an insight that the medium is the message.[35] Combined with the above examples, it means that color can be considered as a medium when it can convey a message based on the specific context. Thus, the understanding of color also needs to be studied in the context of specific fields. In journalism, whether in China or Japan, the use of specific colors to mark disaster levels and warn of evacuation is an example of the practical employment of color.[44] The power of color in journalism is also reflected in the purposeful filtering of the original color of news materials by some news media to influence social perceptions and even manipulate public opinion.[26][37][47]

In Japan, post-edited subtitles are widely used in entertainment programs. Especially in soft content, such as variety shows, visual processing is used to achieve program effects, with colorization of subtitles being one of the common ways. It has been pointed out that visualization of subtitles not only has the effect of facilitating the effectiveness of the program but also has the effect of influencing the audience's understanding of the program.[15][16][46][59] In China, its national official TV news program, i.e., CCTV news program, released new headers with a blue-green background color instead of pure blue in 2020, i.e., a shift of hue from primary hue to intermediate hue, and some changes of tone also can be captured, which implies that the visual optimization of news has gradually attracted official attention. Also, with the popularity of short videos spread by social media, to pursue the visual effects of content, subtitles as a tool decorated by color are gradually being used flexibly.[39]

In the field of journalism, it is noteworthy that the design and application of subtitles for news has also received increasing attention from researchers in recent years, e.g., captioning applications in the news field are focused on disaster warning systems

and screen information discriminations. Moreover, issues such as the appropriate use of captions and the lack of systematic standards are also discussed. However, there is no relevant systematic research, especially in visual research.

Therefore, whether the perception of visual news value can be facilitated or inhibited through visual presentation, i.e., how to realize news value by the visualization of news subtitles, has become the core of this research. Theoretically, the news itself is the reporting of facts; thus, news value is the selection of news facts that have value to be reported, but the value of different news content has fluidity with the times. Some studies point out this issue, e.g., positive news and celebrity news gradually become valuable in terms of its content. However, regardless of the news value itself, the focus of this research is on the visual optimization of the existing news to achieve its news value. Accordingly, it focuses on the presentation of news materials, i.e., the visual presentation of the news with subtitles manipulation while keeping the reality of news itself, to pursue the optimization and maximization of the news value. At the same time, this research is also dedicated to exploring the systematic solutions of news color employment and providing empirical research support for the standardization of visual news information.

In summary, this research has opened up a new perspective by going beyond news value itself and conducting psychological research on news value from the perspective of vision and color, i.e., the form of news value realization. The significance of this perspective is that the potential highly homogeneous news content is grasped in a psychologically measurable form based on visual manipulation, with the aim of realizing that "there is no news without value, only communication without value". Therefore, this research has considerable originality and practical significance.

1.2 | Previous research

1.2.1 | The concept of OCT

The OCT which is a combination of initial capital letters of Open Caption Telop as the description of subtitles has been mentioned in several studies.[58][61][67][68] It is mainly used but not limited to the field of television programs. Concerning the concept of subtitles, there are several terminologies such as Telop, Impact Caption, Superimpose, SDH, and so forth to describe it. Herein, these several concepts would be discriminated against, establishing a clear description for the serious news circumstance.[57]

Subtitles traditionally appear at the bottom of the screen area, hence sub. Whereas, the subtitles appear around all borders of the screen as well as in the center and are non-static, i.e., without spatial or temporal restrictions, is named as Impact Caption, which as it describes this novel use of subtitles, and captures the editorial intention of making an impact. [49][57] Yet, caption alone is quite a generic term and can be used to refer to legend under images and figures, the explanation for images, and even to subtitles themselves.

Subtitles seen on screen in which viewers cannot choose to view the program with or without them are always open is named as Open Caption as shown in Fig. 1. In contrast, the SDH, which has traditionally been used as an aid for individuals with hearing impairments (Subtitles for Deaf and Hard of hearing) is typically referred to as Closed Caption (C.C.), where the viewer can choose whether to have them displayed or not. Also, unlike SDH where nearly all utterances and sounds in the dialogue and narration are displayed, Impact Captions display only selective parts of the current scene.[23][57]

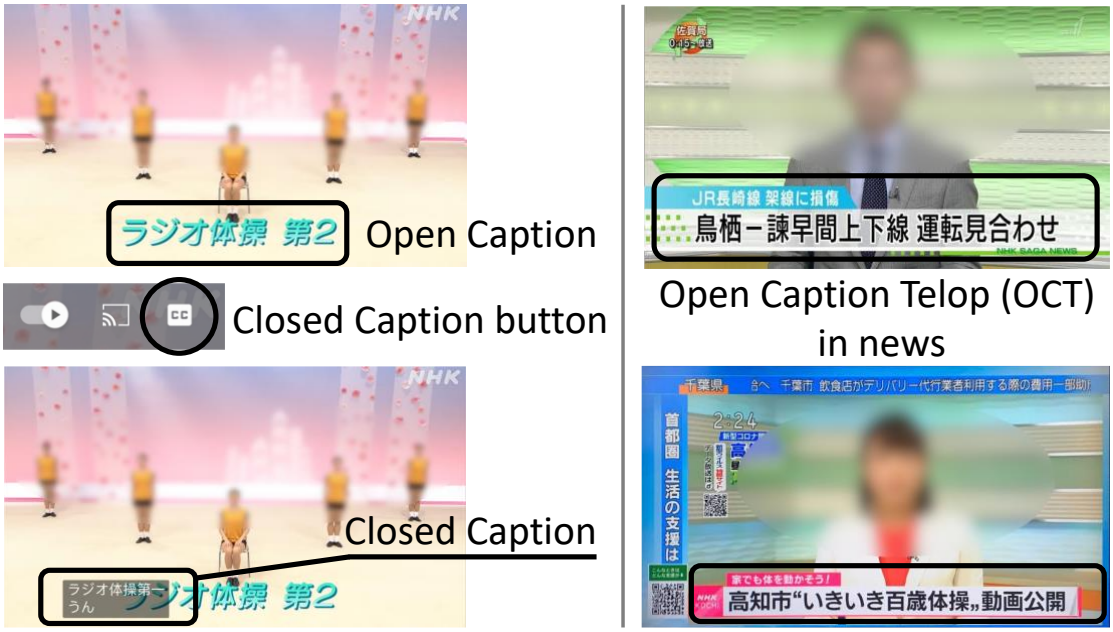

Fig. 1 | The example of OCT actual employment. The left part of this image is an example of a Closed Caption application. By clicking on the cc button circled by the black loop, the captions with their transparent background will be displayed on the screen. The right part of this image is two examples of Japanese news scenes in which two OCT designs circled by black frame were selected. The copyrights of these original materials belong to news agencies.

Telop, which came from Television Opaque Projector[1], is the most common term used in Japan for these captions. It is a device as shown in Fig. 2 used to transmit separately prepared text or graphics directly onto the TV screen without the use of an additional camera. Also, superimpose [13], which is a cinematic technical term, is commonly used in Japan. Both Telop and Superimpose are specific to Japan, and Telop is also limited to textual inserts on TV. Further to this, worldwide people are unfamiliar with these terms and their origins, so comprehension and consistency are difficult, both in the literature and in the industry.[58]

[1] A TELOP (TELevision OPtical Slide Projector) was the trademark name of a multifunction, four-channel "project-all" slide projector developed by the Gray Research & Development Company for Television usage, and was introduced in 1949.

Fig. 2 | Gray Research Telop Machine, Television's First Optical Projection System. This machine was able to televise opaque cards, which was the forerunner of transparent slides. It also had added on features that would allow a news type horizontal ticker scroll across the bottom of the screen (on real ticker tape) and a vertical scroll for credits. The copyright of this image and its descriptions belongs to the person or group with rights.

Therefore, OCT can be considered as a special kind of subtitle that appears on the screen in an open form, and its purpose is to highlight the program or content effect through visual design, rather than only the subtitle text itself (e.g., C.C.). Secondly, it carries the description text, i.e., caption; thus, it has the functional property of subtitles. Furthermore, it is mainly located at the bottom of the screen and has the traditional form of subtitling, i.e., telop, which also can be understood as a solution for visual effects in terms of screen content.

1.2.2 | The current status of color OCT employment

Regarding the function of OCT, several studies have shown that OCT which is

generally used in variety shows, i.e., entertainment programs or gourmet programs could change the impression of the content to viewers. For example, some studies on the gourmet program have clarified that OCT with specific colors can make the cooked dish appear to be more palatable in a cooking TV program.[15][16][55][73]

As introduced above, the usage of OCT is not limited to the entertainment genre. More recently, other similar and dissimilar genres have also incorporated them into their everyday content, most especially in news programs. As it has shown, while OCT may not be as aggressively employed in news programs as it is used in entertainment programming, its use, especially for factual content, may influence viewers in their interpretation and comprehension, especially those relying on OCT to compensate for impaired hearing, limited cognitive processing, limited language proficiencies and in busy everyday scenarios.[8]

Broadcasters have also started to realize the importance of OCT uses in various scenarios other than entertainment programs.[50] For example, in response to Japan's need for more effective emergency warning systems after the Great East Japan Earthquake and Tsunami of 2011, broadcasters have started to modify the linguistic and graphical presentation of emergency warnings on TV. According to NHK, they aimed to achieve intuitive and simple messaging by using short expressions, which is used with simple color combinations to ease reading. Thus, the functions of OCT have already drawn attention to the researcher most recently, and the effects of color on OCT in news are also taken seriously in novel orient.[57][62]

Moreover, another study pointed out the function of OCT. Although the scope of that research is the actual use of OCT in variety shows, it still reflects its important functions. The results of the study show that 92.3% of the 183 participants said they would consciously watch the OCTs, and more than 84% of these people believed that the existence of OCT was necessary. The reasons involved, "Even if the surrounding environment is noisy, you can understand what is being said through OCT", "The information coming in from the eyes is time-sensitive" and so forth. This shows the practical significance of OCT in information transmission.[24][36][56]

From the perspective of mass communication, OCT allows the communicator to

reconstruct and interpret the content, and increase the emotional effect and value of the program through styles including but not limited to colors.[52] For example, Japanese and other Asian TV producers have been deploying multi-colored, and highly visible, intra-lingual OCT on TV programs to enhance their appeal and to influence their viewers' interpretations, which suggests that OCTs are deployed in conjunction with other communicative resources that are deliberately used to influence viewers' interpretations, to enhance and make affective values in TV programs more explicit.[57]

Some studies reveal that although the use of OCT is also increasing in news programs, which may be considered part of tabloidization.[25][35] In these studies, visual effects are only used as part of the media effect research, and visual effects are rarely analyzed specifically, and systematic color research have been almost uncovered. The use of OCT is generally more casual. OCT is usually inserted in post-production editing, largely based on the editors' or directors' intuitions, and not on evidence-based practices based on industrial or official standards. Also, some current issues are emphasized that a consequence of lacking empirical research on OCT will lead to the absence of guidelines for best practice or common usage and a real danger for misuse and potential damage.[57]

1.2.3 | News value introduced in psychology

The study of news value from the perspective of psychology is also gradually introduced in journalism research. An insight on the relationship between journalism and psychology indicates that it is necessary to attempt to apply psychological theories to news decision-making, because empirical data from surveys and studies among journalists are useful to demonstrate the appropriateness of this approach to journalists' behavior.[9] It is an attempt to make use of the evidence in psychology, particularly social and cognitive psychology, to improve our understanding of the news process. This suggests that the experimental research method can play a vital role in journalism. In the following, the cognitive object of this research, i.e., news value, will be briefly

introduced.[18]

News value is a professional terminology in journalism. The definition of news value is roughly consistent, i.e., news value is criteria that influence the selection and presentation of events as published news. These values help explain what makes something "newsworthy". However, the connotation of news value shows specific differences in concept definition, which means that news values are not universal and can vary between different cultures. Among the many lists of news values that have been drawn up by scholars and journalists, some attempt to describe news practices across cultures, while others have become remarkably specific to the press of certain (often Western) nations.[10]

Since Lippmann first introduced the concept of news factors, they have been regarded as professional assessments of the characteristics that make a story worth reporting.[33] Initially labeled "news factors", news values were widely credited to Galtung and Ruge. In their seminal 1965 study, Galtung and Ruge put forward a system of twelve factors describing events that together are used as defining "newsworthiness". In 2001, the influential 1965 study was updated by Tony Harcup and Deirdre O'Neill, in a study of the British press.[66] The findings of a content analysis of three major national newspapers in the UK were used to critically evaluate Galtung and Ruge's original criteria and to propose a contemporary set of news values. Forty years on, they found some notable differences, including the rise of celebrity news and that good news (as well as bad news) was a significant news value, as well as the newspaper's own agenda.[41][42]

Specifically, this research defines the news value based on the fundamental attributes of news and research purpose. The three news value dimensions i.e., the importance (impact/newsworthiness), the novelty (unexpectedness: events that are out of the ordinary, unexpected, or rare are more newsworthy than routine, unsurprising events) and the timeliness (recency: events that have only just happened, are current, ongoing, or are about to happen are newsworthy), were selected. The Fig. 3 that gathers a part of mainstream insights on the news value can be used as a reference. Meanwhile, the news images selected as the emotional context, i.e., the scenes in the following

experiment, were also covered in three emotional tendencies according to news value. Because of the negativity/positivity, i.e., the bad news is more newsworthy than good news, sometimes it is also described as "the basic news value". Conversely, it has also been suggested that positivity is a news value in certain cases (such as sports news, science news, feel-good tabloid stories).[17][42]

Comparing linguists' conceptualisations of news values.

van Dijk (1988): "cognitive constraints that define news values" (121)	Bell (1991): "values in news actors and events" (156)	Montgomery (2007): news values	This paper: news values
Novelty: "news should … be about new events" [not already known by readers] (121)		Recency/Timeliness: "News … deals by definition with 'the new' [new information of recent happenings]" (5)	Timeliness: The event is timely in relation to the publication date: new, recent, ongoing, about to happen or otherwise relevant to the immediate situation/time (current or seasonal)
Recency: "the events described be … recent, within a margin of between one and several days" (121)	Recency: "the best news is something which has only just happened" (156)		
Consonance: "News should be consonant with socially-shared norms, values, and attitudes" (121)	Consonance: "the compatibility with preconceptions about the social group or nation from which the news actors come"; "People have a mental script for how certain kinds of events proceed. Environmental issues, demonstrations, or superpower summits are all perceived to have a typical pattern which they follow. These events will tend to be seen in terms of the script" (157)	Consonance: "classes of event that trigger a 'news script' that strongly determines the shape of coverage" (8); "Even the unexpected event can in its coverage assume familiar contours" (8)	Consonance: The event (including the people, countries or institutions involved) is (stereo)typical in the view of the target audience
Deviance and Negativity: "much news is about negative events such as problems, scandals, conflict, crime, war, or disasters" (123)	Negativity: "the basic news value"; "news is bad" (156) [includes damage, injury, death, disasters, accidents, conflict, war reporting, deviance]	Negativity: "Bad news makes good news." [e.g. war reporting, crime, accident, earthquake, famine, epidemics, disaster, execution] (8)	Negativity: The event is negative for the news publication's target audience, for example an environmental disaster, crime, act of violence, opposition, conflict, controversy, etc

Fig. 3 | Several interpretations on news value from comparing linguists' conceptualization of news values. Red frames indicate the factor of newsworthy that can be treated as the importance/impact of the news. Green frames indicate that the novelty or namely unexpectedness of news. Blue frames indicate the timeliness or namely recency of news.

1.2.4 | The association between color and emotion

According to the previous research, it is relatively abundant in color, emotion, and perception.[21][40][48][63] The association between color and emotion is analyzed from different perspectives such as the effects of color on emotion and the impression of color on specific emotion and so forth. The research methods involve psychological measurement, EEG (ERP), and hypnosis.[6][65][70] The view on the impression and

emotion of the color red varies depending on the context, e.g., a study reported a series of experiments, demonstrating that a brief glimpse of red evokes avoidance motivation and undermines intellectual performance and that it has these effects without conscious awareness or intention,[1] which indicates that red has negative effects since its hindering behavior. Other insights emphasized the bipolar emotional effects of red, which considered that the color red is known to influence psychological functioning, having both negative (e.g., blood, fire, danger), and positive (e.g., sex, food) connotations.[28]

Also, there are several studies on the strength and direction of the effects of multiple hues, e.g., the concept red is affectively quite salient. Black and grey are bad, and white, blue, and green are good. yellow, white, and grey are weak; red and black are strong. black and grey are passive; red is active.[1]

There are also relevant studies that divide colors into main hues and intermediate hues according to the wavelength parameter, e.g., a group of ninety-eight college students was asked to indicate their emotional responses to five principal hues (red, yellow, green, blue, purple), five intermediate hues (yellow-red, green-yellow, blue-green, purple-blue, and red-purple), and three achromatic colors (white, gray, and black) and the reasons for their choices. The results reveal that the principal hues comprised the highest number of positive emotional responses, followed by the intermediate hues and the achromatic colors. The color green evoked mainly positive emotions such as relaxation and comfort because it reminded most of the respondents of nature. The color green-yellow had the lowest number of positive responses because it is associated with vomit and elicited feelings of sickness and disgust.[25]

The above studies explored the association between color and emotion from the perspective of hue. Moreover, the brightness or lightness as one of three attributes of color is also highlighted to reveal the relationship between color and emotion, such as bright colors mainly elicited positive emotional associations, and dark colors mainly elicited negative emotional associations. Also, women responded more positively than men to bright colors, and they also responded more negatively to dark colors.[38][72] Adams and Osgood considered the color component brightness, as determined by

comparing data on white, grey, and black is strongly associated with positive evaluation, but also with negative potency.[1]

Moreover, there is also a comprehensive perspective of brightness and saturation to illustrate the emotional tendency of color, e.g., saturation and brightness are evidenced strong and have consistent effects on emotions. Brightness effects were nearly the same for chromatic and achromatic colors. Blue, blue-green, green, red-purple, purple, and purple-blue were the most pleasant hues, whereas yellow and green-yellow were the least pleasant. Green-yellow, blue-green, and green were the most arousing, whereas purple-blue and yellow-red were the least arousing. Green-yellow induced greater dominance than red-purple.[69]

Furthermore, to study the effect of background color, some studies pointed out the importance of purity when the color is used as a background from a monochromatic perspective, e.g., Maki conducted three experiments to clarify the correlations among their impressions, in which the subjects rated their impressions of color chips and the results suggest that the factors of softness and warmth pertained. [34] Meanwhile, the effect of the background color on the impression of the target color was interpreted. The background color effect on the subjects' impressions was large on clearness and serenity. And when color is used as a background color condition, it also has a significant contextual effect on memory, e.g., Isarida investigated background-color context effects by the free recall. A total of 194 undergraduates studied words presented one by one against a background color, and oral free recall was tested after a 30s filled retention interval. A signal for the recall was presented against a background color throughout the test. Recalled items were classified as same-context and different-context items according to whether the background colors at study and test were the same or different. The context effects were significant. The results indicate that the change of background colors is necessary and sufficient to produce context effects.[64]

A study on EEG (ERP) has confirmed that red has the role of guiding attention in positive and negative emotional conditions, and it also emphasizes the role of emotional context, e.g., Kuniecki et al. suggested that the color red captured and later held the attention in both positive and negative conditions, but not in a neutral condition. Thus,

red seems to guide attention, specifically in emotionally-valenced circumstances, which indicates that an emotional context can alter color's impact both on attention and motor behavior. [28] As mentioned above, the hypnosis method is also used to compare the emotional effects of color by lighting, which suggests that red is the most exciting and blue is the calmest, and the effect of purple is between the red and blue. Considering the importance of context, e.g., Aaronson conducted that the responses of three hypnotic subjects and one simulator to a set of suggestions attempting to simulate colored light are compared. The results show that colors seem to range themselves in an activation series going from red as the most activated to blue as the most tranquil. Purple, the result of mixing red and blue, seems intermediate inactivation. Color responses seem also influenced by associated metaphors and by context.[7]

In addition, a study on the color impressions for establishing evaluation scale, indicated the three dimensions of each color, which has certain reference significance for later experimental analysis, i.e., Kobayashi devised a Color Image Scale by the use of an original color-projection technique, analysis of variance, cluster analysis, factor analysis, and the semantic differential method. On this scale, every color has three attributes: warm or cool, soft or hard, and clear or grayish, which correlates with the notation hue, value, and chroma. The Color Image Scale is useful for describing similar and contrasting images of colors. The scale also allows the classification and correlation of various objects (shapes, patterns, clothing, foods, etc.).[27]

1.3 | Theoretical background

The color-in-context theory

The theory is developed by Andrew J. Elliot[2] and Markus A. Maier[3] (cf. the *Advances in Experimental Social Psychology, Volume 45 1st Edition, 2012*).[3][51] They pointed out the lack of empirical research on color in psychology, and through a series of ostensible experiments (The experiment itself is not the real purpose of the experiment) to confirm that the red in different contexts such as achievement and affiliation have different effects. Their theory also emphasizes the importance of the three attributes of color, namely hue, lightness, and chroma. This research is partly based on the theory. Specifically, there are several principles as shown below in line with this research. In the principle 1, they emphasize that color can have functional value, which can be the origin for proposing the thought direction of news value. In the principle 2, the psychological attribute is proposed for interpreting the meanings of color, especially the neural processing in the valenced appraisal processes when cognizing the meanings of color. Besides, in the principle 6, the insight that the meaning of a color is determined by its contextual surround is revealed, which influences this research involving within the specific context.

Principle 1: Color carries meaning

When most people think about color, they tend to think about aesthetics. The most rudimentary premise of the color-in-context theory is that color is not just about aesthetics, it also carries meaning. Colors have associations that contain psychologically relevant meaning beyond intrinsic pleasantness–unpleasantness appraisals. Accordingly, color may be seen as a non-lexical visual stimulus that can symbolically convey various types of information. That is, color can have functional value as well as aesthetic value. Each of the three properties of color-hue, lightness, and chroma can carry meaning and have functional value.

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Principle 2: Viewing color influences psychological functioning

The perception of color influences psychological functioning in a manner consistent with the meaning of the color. Viewing color gives rise to evaluative processes that appraise stimuli as hospitable for or hostile to the perceiver. Hospitable and hostile appraisals engage appetitive or aversive motivation (respectively), and concomitant affect, cognition, and behavior. Evaluative processes operate via multiple, partially overlapping mechanisms, from rudimentary spinal cord reflexes to complex cortical calculations, and color meanings may be represented and may evoke valenced appraisal processes, across these different levels of the neuraxis. Thus, colors that carry positive associations evoke a suite of approach-oriented psychological processes, whereas colors that carry negative associations elicit a suite of avoidance-oriented psychological processes.

Principle 6: Color meanings and effects are context specific

Context has been largely ignored in theoretical and empirical work on color psychology. Central to the color-in-context theory is the idea that color carries different meanings in different contexts and, therefore, has different implications for feelings, thoughts, and actions in different contexts.

The circumstances that frame, and give meaning to, color may be physical or psychological. Neuroscientists have clearly shown that color perception is influenced by other features of visual perception such as shape, texture, motion, contrast, and spatial orientation.

The meaning of a color is determined by its contextual surround. Some colors, especially those most salient across time, language, and culture, may have default meanings. Such meanings would represent either the most salient association to the

color (e.g., purity for white) or its most negative meaning (e.g., danger for red), given the “bad is stronger than good” principle. In instances in which contextual cues are neither strong nor salient, the default meaning is activated. However, in the main, color meanings are contextually constructed, and failure to attend to this basic reality is problematic. Indeed, the vast majority of research on color psychology has neglected to consider color-in-context, and we believe that this oversight is largely responsible for the accumulation of inconsistent empirical data that have hampered progress and growth in this promising area.

1.4 | Research Framework

Considering the research purpose, previous research and theoretical background together, the research framework of this thesis has been presented as shown in Fig. 4. The two main foundations of this research are psychology and journalism, respectively. In which, the perception of color (hue, tone) and emotion (negative, neutral, positive) belongs to the scope of psychology, while the understanding of OCT and media (traditional broadcasting, social media) belongs to the scope of journalism. They are bridged by the news value, i.e., importance, novelty, timeliness, which is the main body of this work. Emotion and media belong to the context, and they are taken together as the basis for exploring the news value.[60]

Based on the current research on whether there is an association between color OCT and news value as Study 1 (Chapter 2), i.e., whether color manipulation of OCT causes a change in participants’ perception of news value. This is also considered to be the basis of this research. Here it corresponds to the Color OCT box in the lower center of the figure. Based on the core mentioned above, the actual effect of OCT color manipulation was explored in the emotional and application contexts, respectively. The emotional context was chosen with a view to news content communication (Chapters 3

and 4), while the application context was considered with a view to news form communication (Chapter 5). Chapters 3 and 4 are more closely connected to psychology, while Chapter 5 is closely connected to journalism, i.e., the dashed box in the figure and the part marked by the corresponding text outside. This is an important manifestation of interdisciplinary research. The three chapters are related and independent of each other, i.e., they are formally related rather than causally associated with each other. Accordingly, each chapter can be considered independently.

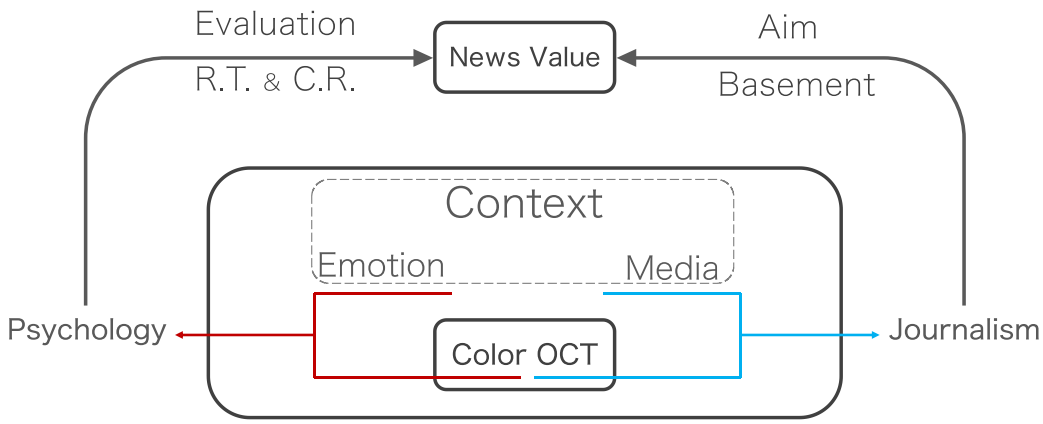


Fig. 4 | The research framework unifies psychology (color, emotion) and journalism (OCT, media) on news value.

CHAPTER 2

The effects of hue and tone of OCT pattern on perception of news value

2.1 | Introduction

According to the previous research, the study on the visual effects of OCT is mostly concentrated in the field of entertainment-oriented mass communication content, such as entertainment shows, movies, TV series, and other forms. In journalism, the lack of empirically-based reception studies, and the effects of color in the news context is unclear. However, scholars have gradually begun to focus on the visual communication effects of news in recent years.[58] But there is still little research from the perspective of color. Therefore, as a whole, it is necessary to clarify the news value perception by the OCT color in the specific context. In this section, the issue that whether the OCT color can change the perception of news value including the dimensions of importance, novelty, and timeliness was explored.

Then, the hypothesis of this section will be proposed as follows. Although color as a powerful tool has been recognized in information processing, there is yet no evidence detected in the news context whether or not the color has certain effects to influence the perception, especially the manipulation of subtitle colors for the perception of news value. Whether the differences between colors exist or not, it is also blurred; thus, there should be no significant difference among them. In other words, the OCT manipulated by color and the OCT without color should have the same effects on the perception of news value. Besides, OCT manipulated by different chromatic colors may have the same effects on news value perception. Moreover, are there individual differences among participants in these perceptions?

2.2 | Method

2.2.1 | Stimulus

The purpose of this research is to clarify the effects of color under the framework of news than tabloid content. Generally, OCT processed by multi-color is more often used in entertainment shows, which may be incompatible with the news field, and it is not within the scope of this research. Thus, the original stimulus, i.e., a kind of OCT, has been designed regarding the actual news programs. The features of OCT used in the following experiments are that the appearance looks monochrome instead of multi-color, more uniform than scattered, and keeps closer to the moderate style of news, especially similar to the current OCT's style employed in the Chinese news program.

As shown in Fig. 5-1, the OCT pattern can be divided into two parts: graph and text. Graphic part 1 is the text carrying parts, and the background color is white-gray. To achieve a visual balance between OCT and news background, a 5% transparency was manipulated on the graphic part 1. Graphic part 2 and 3 are color-carrying components, where part 2 is a bar shape, and part 3 is a bubble shape. Text part 1 is a Japanese/Chinese component, and the content carried correspond with the news content, which is the words *Earthquake, Transaction, and Support.* Text part 2 as an icon indicates the news channel.[43][53]

What needs to be reminded is that to apply to both Chinese and Japanese participants, the Chinese characters "SHIMBUN/XINWEN" in the character Part 1 are Japanese Chinese characters, which is the meaning of news instead of newspapers. The indicative information is used Roman letters, i.e., NEWS in bubble component, and the character itself is colored by achromatic hue. Also, the font is Gothic regardless of language.

Fig. 5-1 | The OCT pattern. The image of the Chinese character in the center of the graphic part 1 can be translated to NEWS in English. This pattern was designed by using Adobe Illustrator (Ai) version 2019.

In this study, as shown in Fig. 5-2, the color arrangement was based on the PCCS (Practical Color Co-ordinate System) color system, because of which has the psychological equivalence in visual perception and the regularity of tone gradation. Three tones, i.e., bright tone (b), vivid tone (v), and deep tone (dp), corresponded with the eight chromatic hues, i.e., red, orange, yellow, YG (Yellow-Green: yG/YG), green, BG (Blue-Green: BG /Light blue: Lb), blue and purple, were selected from the PCCS color hue ring respectively. The colors selected are consistent with the spectral order and have the accurate visual discrimination. As shown by Fig. 6, the three-toned OCTs used in the actual experiment period were presented.

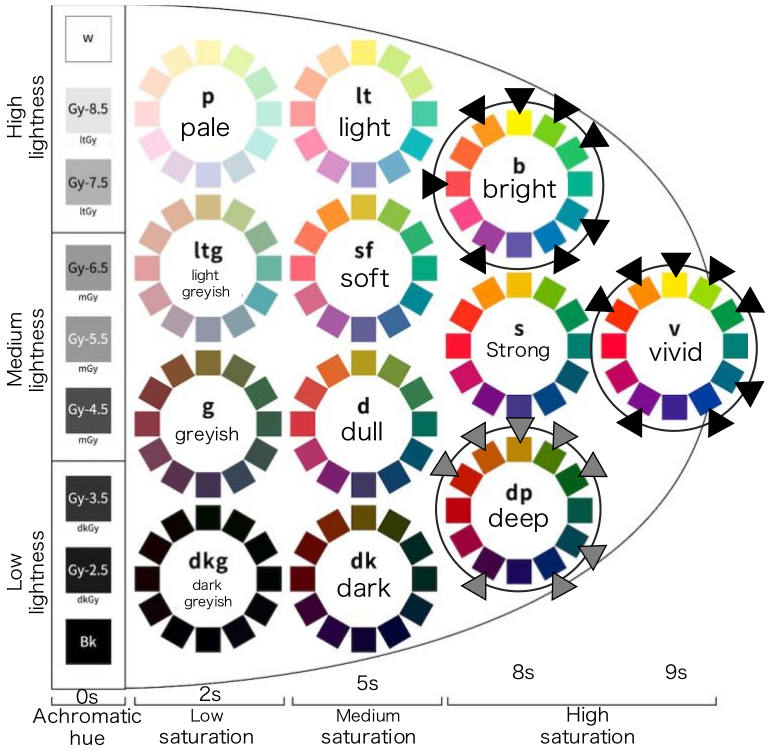


Fig. 5-2 | The PCCS color system. In this research, the vivid (v) tone (*v3, v6, v8, v10, v11, v16, v18, v22*), the bright (b) tone (*b2, b6, b8, b10, b12, b16, b18, b22*), and deep (dp) tone (*dp2, dp6, dp8, dp10, dp12, dp16, dp18, dp22*) corresponded eight hues circled by black loop were selected respectively.

Fig. 6-1 | The OCT variations by eight chromatic hues with the bright tone

Fig. 6-2 | The OCT variations by eight chromatic hues with the vivid tone

Fig. 6-3 | The OCT variations by eight chromatic hues with the deep tone

2.2.2 | Participants

Thirty-one participants were recruited. There were thirteen males and eighteen females (20–69 years, *M = 29.16, SD = 9.79*). Of all participants, twenty-four people indicated that they had never participated in similar experiments before. Seven people indicated that they had participated in psychological experiments before, including four people that they had participated in experiments similar to the current experiment more than twice, and the remaining three people indicated that they had hardly participated in experiments similar to the current experiment before.

Of all participants, twenty-two people indicated that they participated in this experiment by wearing colorless and clear myopic glasses, and all of them indicated that they wore myopic glasses on a daily basis. All participants who wore glasses were asked to make sure that the lenses are clear and non-tinted during the experiment. Wearing other eyewear other than for vision correction, including but not limited to sunglasses, etc., was not acceptable in this experiment. Regarding color vision, all participants indicated that they had previously been given and passed the Ishihara test. Thus, all had normal or corrected-to-normal visual acuity and color vision. The participants were provided with informed consent at the beginning of the experiment.

2.2.3 | Apparatus and Experimental Environment

The monitor used in this experiment is a 24.1" LED display (EIZO, EV2456) manufactured in 2019. The screen has a native resolution of 1920 × 1200 (16:10 aspect ratio) with a pixel density of 94 PPI. The contrast ratio is 1000:1, and the color gamut is equivalent to sRGB. Microsoft PowerPoint was used for stimulus presentation. All colors used in experiments were calibrated with a KONICA MINOLTA CA-100 series luminometer.

This experiment was conducted indoors. An LED ceiling light was used, and it had a brightness of 1200 lumen and a color temperature of 5000K. Every participant was

required to check the room's brightness before the onset of the experiment. In addition, to keep the indoor comfort, the temperature and humidity were adjusted to 24 degrees Celsius and 40% RH respectively.

2.2.4 | Procedure

As a general research method used in psychology, especially in journalism, the semantic difference (SD) method was deployed to match the experiment.[22] First, participants were instructed to sit down and keep their eyes from the display about 50 cm. Then, launching the Microsoft PowerPoint, the personal information box including the age, gender, nationality, and so forth appeared, and it needed to be filled out. Then, the descriptions were presented, saying that imagine the scenes when you are watching the news on the screen. Participants were asked to confirm it and by scrolling down the page to start.

When entering the trials, the stimuli, i.e., the colored OCT patterns (manipulated by eight chromatic hues and corresponding with three tones), were randomly presented in the center of the screen (see Fig. 6). Simultaneously, as shown in Fig. 7, the 201-point scale (-100–0–100) which is from -100 (inhibit the performance of news value) to 100 (facilitate the performance of news value) with a center of 0 (neither inhibit nor facilitate, as the control condition) appeared below the stimuli images. The scale was used to evaluate that whether such OCT can inhibit or facilitate the importance, novelty, and timeliness.[45]

Participants were asked to write down their evaluations in a paper prepared to advance the experiment. When all seventy-two trials (8 hues × 3 tones × 3 news value dimensions) were completed, the experiment was finished automatically.

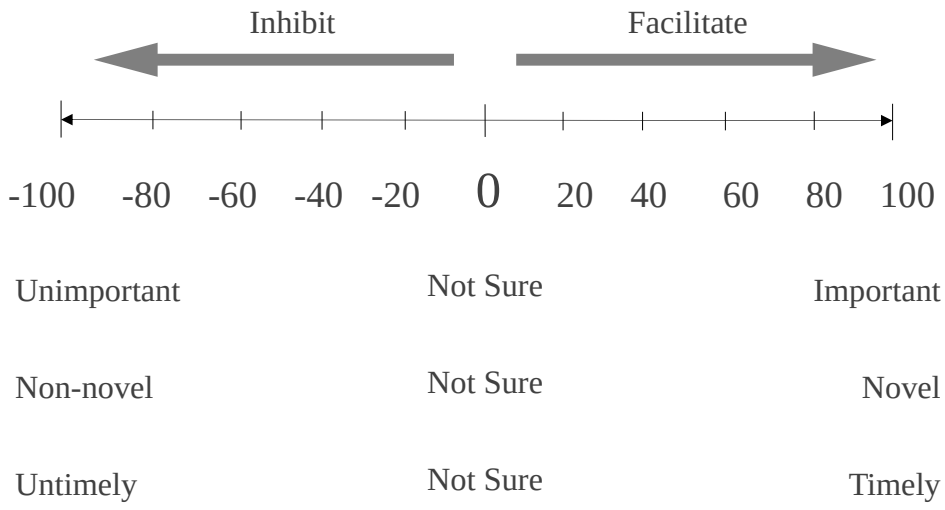


Fig. 7 | The evaluation scale used in the experiment

2.3 | Results

2.3.1 | The individual differences of the news value perception by the OCT color

According to the cognitive evaluation, the distribution of OCT color on the perception of importance, novelty and timeliness by proportional presentation can indicate the performance of color, i.e., it can intuitively show the color engagement.[4]

Concerning the charts, its abscissa ranges from -100% to 100% corresponding with the evaluation scale in the experiment, and the ordinate represents the color data of each participant from number one to number thirty-one. The data was presented as a percentage, as the color evaluated as a negative number corresponding to the left area of the ordinate, and the color evaluated as a positive number corresponding to the right area of the ordinate. The evaluation ratio was converted, regardless of the positive or negative number, and the sum of all eight hues is 100%. Specific to the data of each

participant, the overall performance of the color can be judged according to the position of the data band in the coordinate system, and within the data band (the length of the color band) the color ratio can be understood the performance of a particular color.

For judging the news importance, the majority of participants thought that the OCT manipulated by color makes the news value change, as shown in Fig. 8. Regardless of the hue or tone, the results suggest that the OCT processed by color facilitated its news importance than inhibited the news importance, which implies that most chromatic color has a certain effect on performing the news importance. By contrast, a little part of color OCT manipulations inhibited the perception of news importance. The evaluation distributions and the individual differences were analyzed in the following.

According to the data, 29%, 25%, and 25% of the participants in the conditions of bright, vivid, and deep tone were nine, eight, and eight people respectively. All of them evaluated all colors or the partial colors by positive values, i.e., colors can completely help to facilitate the news importance realization. In other words, at least a quarter of the participants firmly believed that the OCT color can make the news more important than the control condition, i.e., non-color condition. Among them, five people thought that OCT manipulated by all selected hues can facilitate the news importance in the bright tone condition, although each hue has different effects since the proportional size. For the remaining four participants, No.4 considered that the effects of yellow, YG, BG, blue and other colors were zero; No.6 thought that the effects of YG color were zero; No.14 thought that all colors except yellow and YG did not affect the importance; No.30 considered that purple did not affect the importance. In vivid tone conditions, 6 people believed that all colors can facilitate the importance, although the effectiveness of each color was different regarding the proportional size as shown in Fig. 8-2. For the remaining two people, No.4 considered that the effects of colors other than red, yellow, and purple were zero; No.14 thought that BG, blue, and purple did not affect the importance. In deep tone conditions, six people believed that OCT by all colors can facilitate the news importance as shown in Fig. 8-3. The other two people, No.4 thought that the colors of orange, yellow, BG, and blue did not affect importance; No.23 considered that the effects of orange, yellow, and YG were zero.

Also, some participants believed that OCT by color can enhance the news importance to varying degrees. According to the proportion of color composition within each data band, it can be observed that in the bright tone condition 6 participants believed that some color manipulation inhibited the news importance as shown in Fig. 8-1. Among them, four people thought the effects of YG color and three people thought the effects of purple to be negative. There were six participants whose data distribution was less than -20% and greater than or equal to -40%, and two of them respectively considered the effects of YG and purple to be negative. The evaluation of the negative effects of the three primary colors was also observed by individual participants. For example, No.24 thought that the effects of red and green were negative, while No.15 thought that the effects of yellow and blue were negative. There were also six participants whose data distribution was less than -40% and greater than or equal to -60%, and the data of these six people was all over -50%, which indicates that some color manipulations are difficult to facilitate the news importance under the bright tone condition. Among them, four people thought that the yellow, YG, and green, three people considered that the orange color, and two people thought that the purple inhibited the news importance respectively. There were three people whose data ranged less than -60% and greater than or equal to -80%. The No.2 considered that only warm colors such as red, orange, yellow can enhance the news importance, while other hues weaken it. No.23 and No.29 were similar, and their data suggests that hues other than green and blue cannot highlight the news importance. Participant No.26 whose data distribution ranged less than -80% and equal to -100%, i.e., except blue other hues inhibited the news importance.

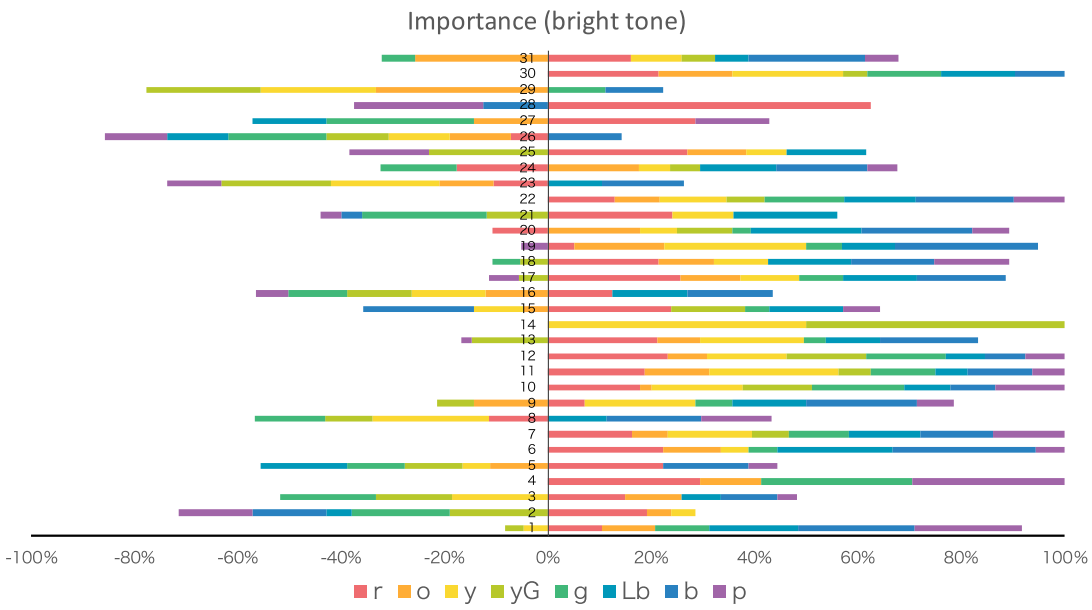


Fig. 8-1 | The distribution of OCT color by eight chromatic hues with the bright tone on the news importance dimension

In the vivid tone condition, seven participants believed that some color processing inhibited the news importance as shown in Fig. 8-2, in which the data distribution was greater than or equal to -20%. Among them, 4 participants believed that the effects of purple were negative, and three participants considered that the YG color effects were negative. There were six participants whose data distributions were less than -20% and greater than or equal to -40%, mainly involving yellow, YG, green, purple, and other hues, and some participants such as No. 9 thought that the orange and blue weakened the news importance. The data distribution of six participants with less than -40% and greater than -60%, and the hue involved was roughly similar to the above. The data distribution of three participants with less than -60% and greater than -80%, different from the above mentioned, the negative evaluation of these three people included BG, blue, purple, etc., i.e., this kind of colors may inhibit the news importance. Participant No.29 whose data distribution was less than -80% and equal to -100% considered that all hues except red may inhibit or weaken the news importance, especially the evaluation of orange color exceeding -50%.

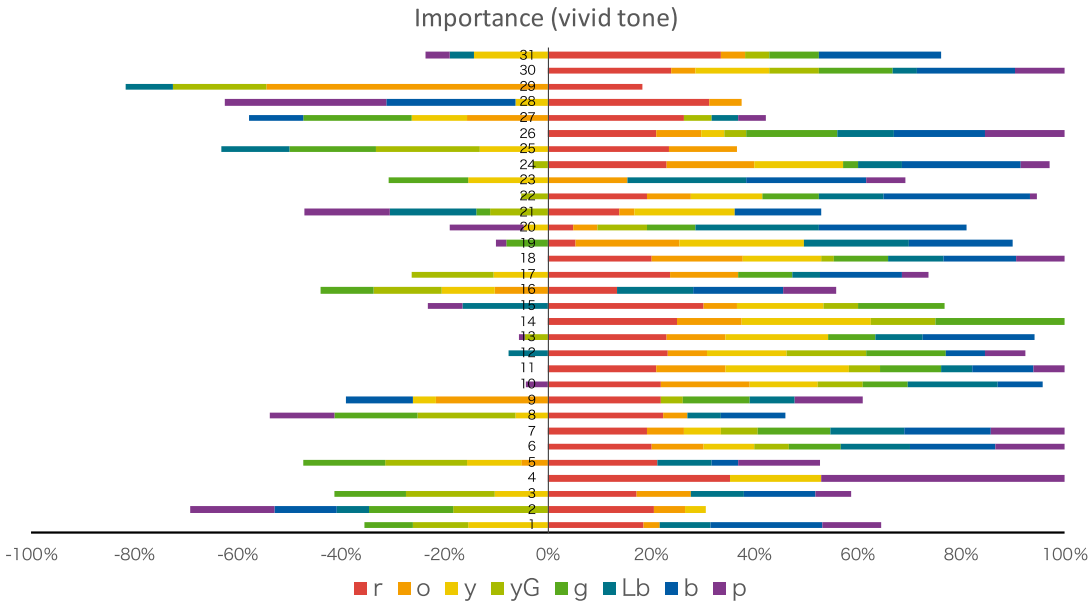


Fig. 8-2 | The distribution of OCT color by eight chromatic hues with the vivid tone on the news importance dimension

In the deep tone condition, as shown in Fig. 8-3, it is different from the above-mentioned. There were data that such as No. 21 thought all colors processing was negative, and all color evaluated were zero from the No. 14. There were seven participants whose data distributions were greater than or equal to -20%, which suggests that some color manipulation inhibited the news importance. Five of them believed the YG color effects to be negative. There were eight participants whose data distributions were less than -20% and greater than or equal to -40%. Among them, most people thought that the effects of green on the news importance were negative. There were three participants whose data distribution was less than -40% and greater than or equal to -60%, including yellow, green, purple, etc. There were two participants whose data distributions were less than -60% and greater or equal to -80%, and their data involved purple and blue. Different from all other participants, No.25 believed that only YG colors can enhance the news importance, which indicates the existence of individual

differences.

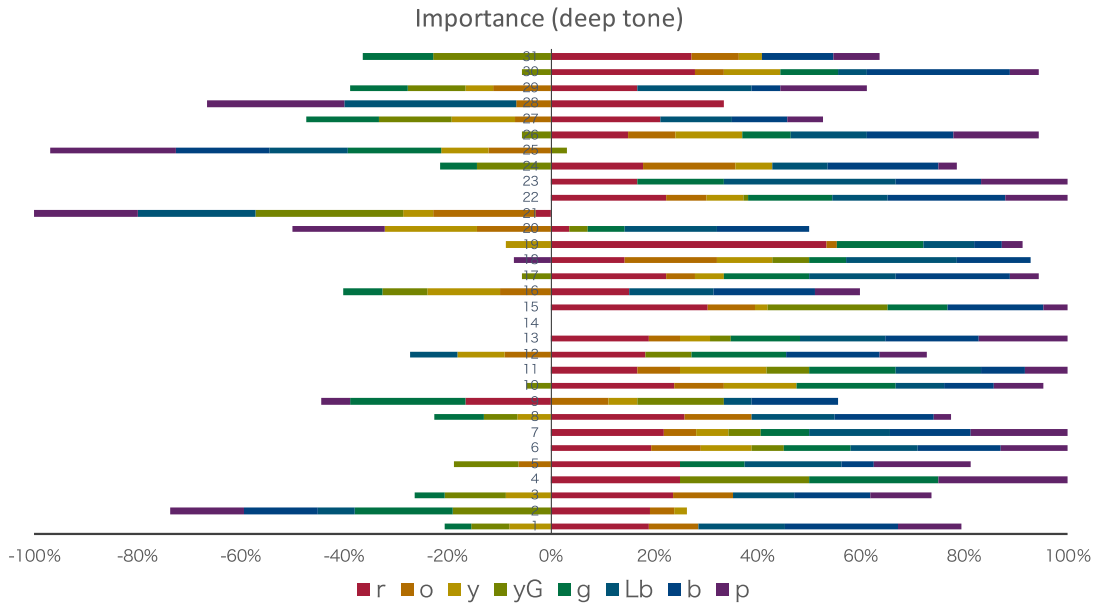


Fig. 8-3 | The distribution of OCT color by eight chromatic hues with the deep tone on the news importance dimension

On the whole, there were some differences observed in the perception of news novelty under the three tones as shown in Fig. 9. It mainly reflects in the larger extents on the perception of the bright tone condition, because most of the data distribution concentrated on the right side of the coordinate system. By contrast, some hues in deep and vivid tone conditions show that make the news visually non-novel.

In the bright tone condition, as shown in Fig. 9-1, only the data distribution of No.21 shifts to the left by more than 50%, while the data of No.2 is close but not more than 50%, and the remaining 93% participants' data distributions were on the right side of the coordinate system with its center of gravity. Thus, in light-toned OCT conditions, the bright tone has a more positive influence on the perception of news novelty. By observing the left side of the coordinate system, it was found that the data of about 38% of participants shows that the blue series, i.e., BG, and blue have a passive effect on the

news novelty. The data of only about 9% of participants shows that the YG color weakens the news novelty. By calculating the mean value, the YG color was 32.10 and the red was only 32.90. The difference between the two colors is subtle.

Regarding the data bands on the right side of the coordinate system, it can be found that the proportion of purple was visually more prominent than the news importance dimension. The mean value of purple was 29.81, compared with 8.10 in the importance dimension. It is worth noting that according to the data of No.30, only purple can facilitate the perception of news novelty, and the other colors were the same as the control condition. While, the data from the No.19, 23, 27, and 28 shows that the effects of purple were equivalent to the control condition. It can be observed that there were strong individual differences when purple was used to indicate the news novelty. Besides, except for little negative evaluation from No.34, the yellow, its mean value was 41.13, which is the highest level within the hue. The mean value of the orange color was 34.26 next to the yellow. The part of the intermediate hues such as orange, YG color had quite obvious effectiveness in the news novelty performance.

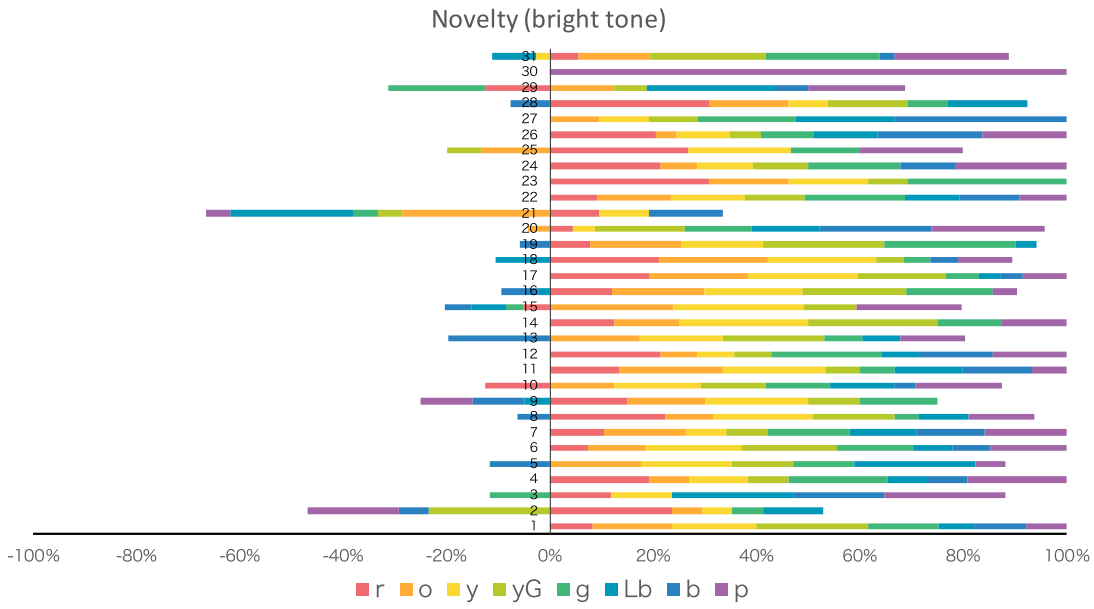


Fig. 9-1 | The distribution of OCT color by eight chromatic hues with the bright tone on the news novelty dimension

In the vivid tone condition, as shown in Fig. 9-2, the number of participants whose data bands shifted to the left by more than 50% increased from one to four in the above conditions, and there were two participants whose data was close but not more than 50%. The data of No.29 shows that only purple can make slight effects for novelty, and other hues inhibited the news novelty. In particular, the orange, YG, and purple show the cognitive deviation. About 22% and 19% of participants, i.e., seven and six people indicated that the orange and YG color inhibited the news novelty respectively. Regarding the purple, about 29% of participants, i.e., nine people, believed that the OCT manipulated by color weakened the news novelty. It is worth noting that the performance of green shows more eye-catching in this tone condition. The mean value was 35.65 as the highest score among the hue, which suggests green in this condition can facilitate the realization of news novelty.

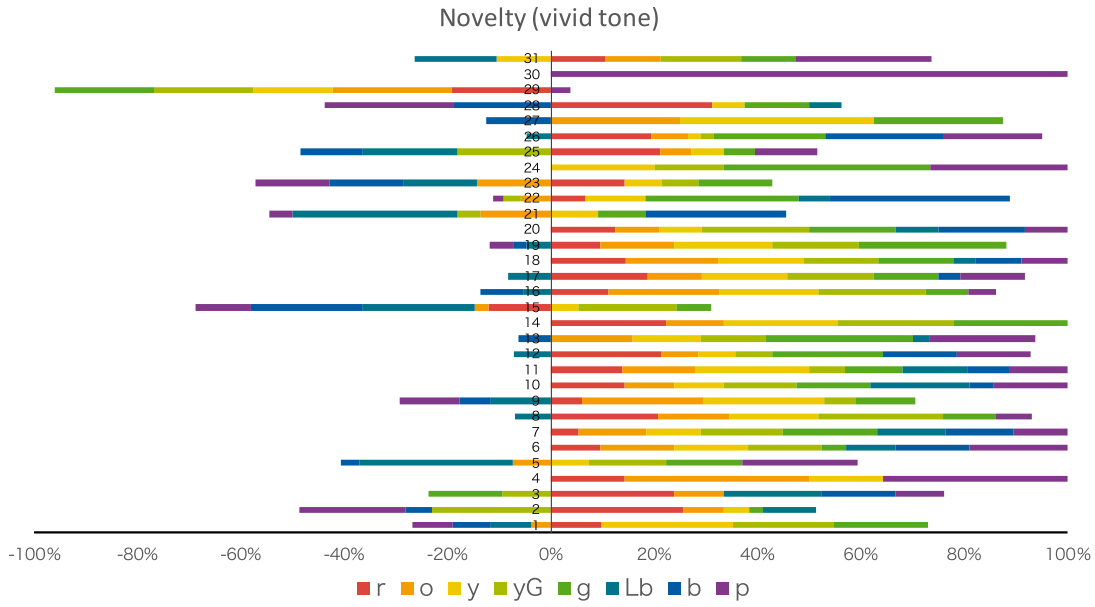


Fig. 9-2 | The distribution of OCT color by eight chromatic hues with the vivid tone on the news novelty dimension

In the deep tone condition, as shown in Fig. 9-3, the data distribution of about 41% participants, i.e., thirteen people, shifted to the left by more than 50%, which indicates that the partial hues seriously weakened the news novelty. However, there were not all negative values in this condition, slightly different from the foregoing. Generally, red was relatively in a stable state, and the mean value was 25.81 as the highest, though some participants believed that it weakened the perception of news novelty. The mean value of green was 13.84, and about 78% of the participants, i.e., 24 people, considered that OCT colored by deep-toned green was perceived fresher. Besides, the data such as the orange, yellow, YG, purple were relatively scattered, and the mean value was -0.52, 4.58, 1.97, 1.55 respectively, i.e., near the control condition. It reveals that not only the hue but also the tone manipulation can influence the perception of news novelty.

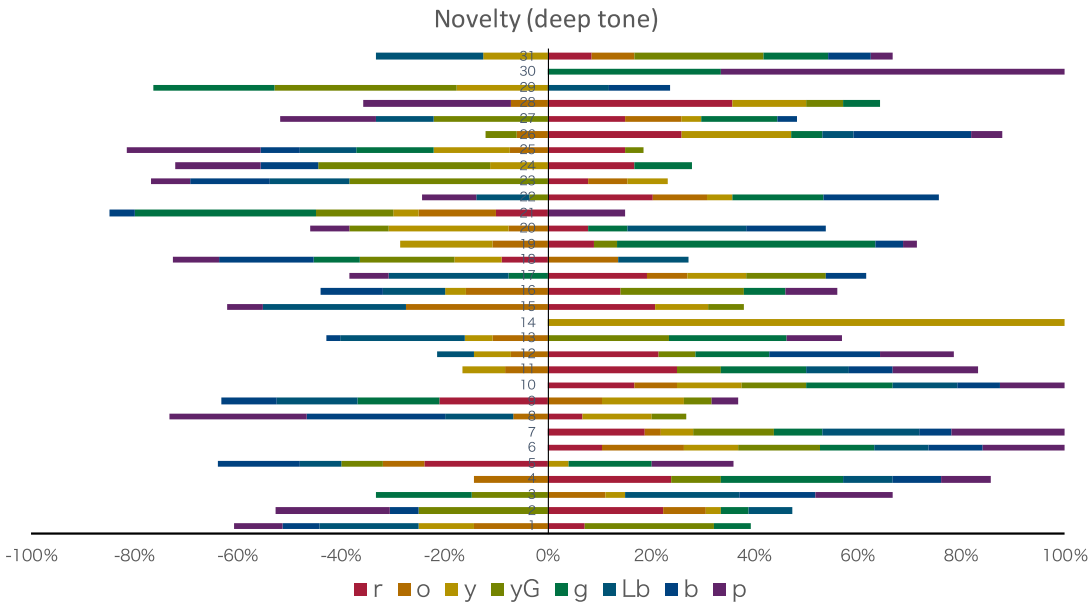


Fig. 9-3 | The distribution of OCT color by eight chromatic hues with the deep tone on the news novelty dimension

Concerning the news timeliness dimension, as shown in Fig. 10, the results of news

timeliness perception show the advantages of primary color. As for the significant quantitative differences between the various color conditions, it will be further explained in the subsequent analysis of variance.

In the bright tone condition, according to the data of 87% of participants, i.e., twenty-seven people, its center of gravity distributed on the right side of the coordinate system as shown in Fig. 10-1, which indicates that most colors can visually facilitate the news timeliness. The remaining 13% of participants were four people whose data distributed on the left side of the coordinate system. By analyzing the data composition of these four people, it can be observed that the positive evaluation of both No.2 and No.4 consists of red plus an intermediate color, and the composition of negative evaluation was quite different; the positive evaluation of No.8 and No.9 was composed of two primary colors plus an intermediate color. The composition of negative evaluation greatly differed among the individuals. It is worth noting that only No.9 believed that the red weakened the news timeliness and was not limited to the current tone condition. Also, except for No.9, all of these four people believed that YG color inhibited the perception of news timeliness. Besides, in the negative evaluation, within six Japanese participants, the four people thought that purple inhibited the performance of news timeliness, and one person thought that purple had no effect, whereas only one person thought that purple can facilitate the news timeliness. Intuitively, the distribution of the yellow area was more eye-catching, and the mean value reached 41.77. The mean value of red was 48.45. Considering the performance of purple above-mentioned, its mean value was only 2.77.

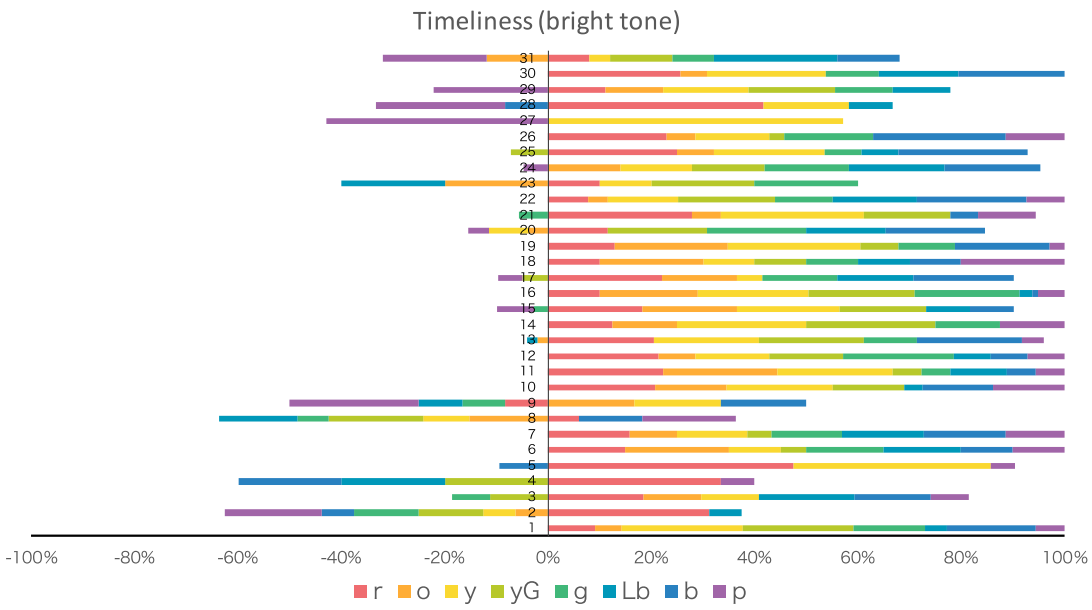


Fig. 10-1 | The distribution of OCT color by eight chromatic hues with the bright tone on the news timeliness dimension

In the vivid tone condition, as shown in Fig. 10-2, the data center of three participants located on the left side of the coordinate system, and the data center of two people distributed close to -50%. In the negative evaluation, about 32% of participants, i.e., ten people, thought that the mean of BG color cannot help to the realization of the news timeliness. About 22% of participants, i.e., seven people, considered that the orange color was not suitable for timeliness expression. About 29% of participants, i.e., nine people, thought that YG color was not suitable. The purple with an average of 4.81 was observed slightly stronger than the other color conditions.

By confirming the positive evaluation, the mean value of red was 52.48 which shows slightly higher than the other color conditions. Among them, in addition to the negative evaluation on red, No.15 and No.23 evaluated zero to red, which suggests that they did not agree with the effects of red on timeliness. The yellow and green were roughly similar since their mean was 30.45 and 29.23 respectively.

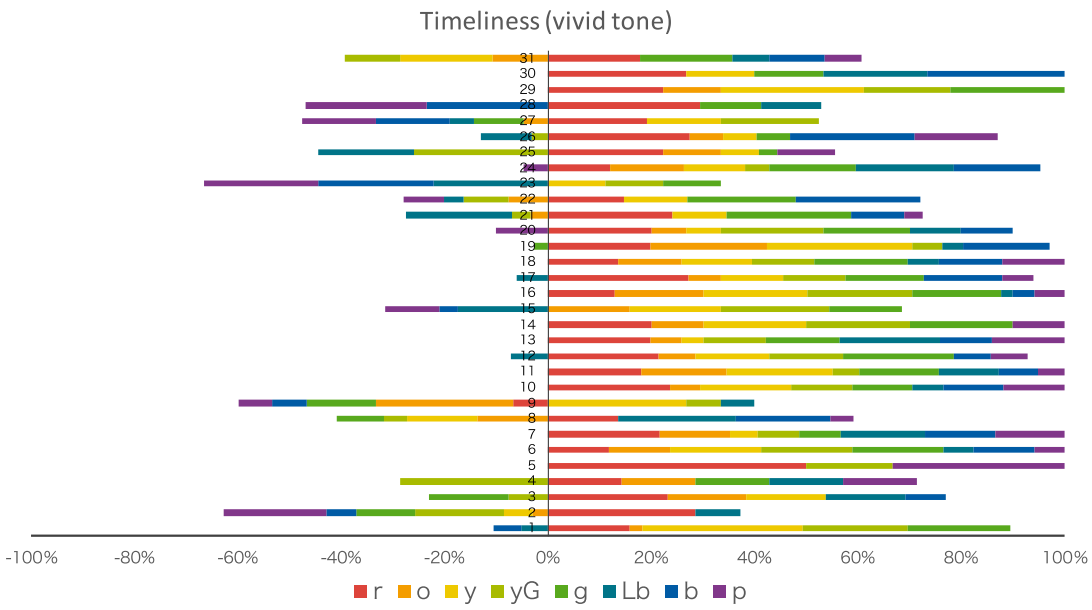


Fig. 10-2 | The distribution of OCT color by eight chromatic hues with the vivid tone on the news timeliness dimension

In the deep tone condition, at least a quarter of the participants, i.e., more than eight people, their data center distributed on the left side of the coordinate system as shown in Fig. 10-3, which indicates that the news will be sluggish in these conditions. In the positive evaluation, i.e., on the right side of the coordinate system, three people believed that all colors had varying degrees of effects for indicating the news timeliness in this condition, compared to the data including zero evaluation on the bright and vivid tone corresponding with the thirteen and eleven people respectively. It can be judged that part of the hues may inhibit the perception of news timeliness in this condition.

Regarding this condition, the red which has a mean of 51.39 remained as higher as before. The yellow plummeted to 1.77, which suggests the effects of the lightness. The green which has a mean of 14.26 dropped to the half comparing the above condition. The blue which was not as highly evaluated as other colors kept in a relatively stable status, and it did not lose the advantage as the primary color. According to the data of intermediate color, most of them were in a low or even negative evaluation state except for the BG color, e.g., the mean of orange was only 0.36, and the YG color was even as

lower as -10.55.

In summary, considering the news timeliness, the primary hues were generally stronger than the intermediate hues, and it is necessary to conduct further analysis to clarify the specific quantitative differences.

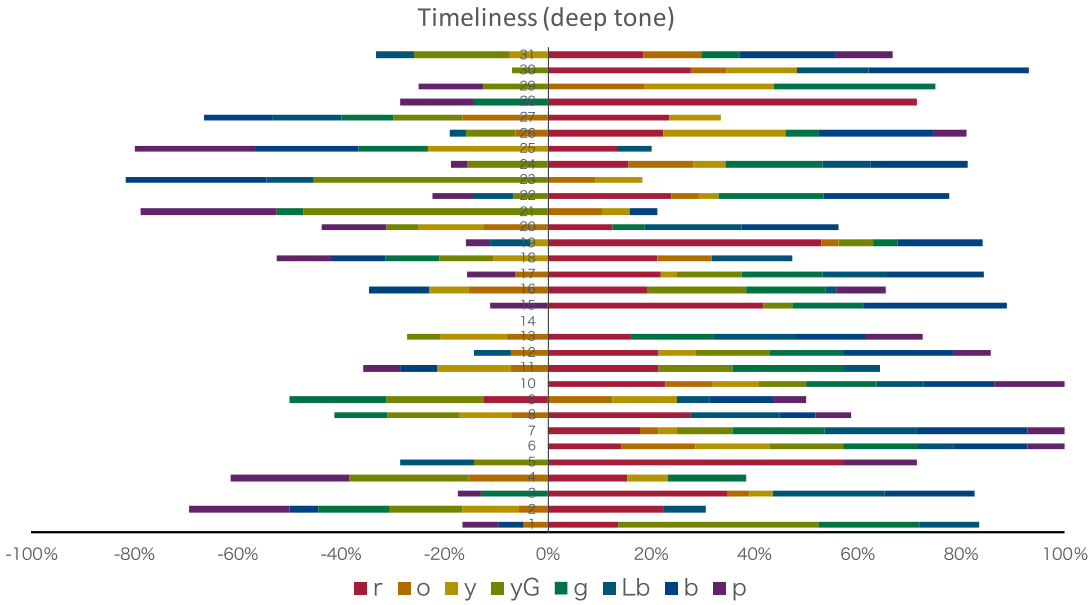


Fig. 10-3 | The distribution of OCT color by eight chromatic hues with the deep tone on the news timeliness dimension

2.3.2 | The cognitive differences of news value perception by OCT color

According to the hypothesis, significant differences between color conditions on the perception of news value were clarified by the repeated measures ANOVA. The results of the importance dimension were shown in the following. The significant difference of the main effects was only observed in the hue factor [F (7, 210) =17.904, p <.001], and the interaction between the factors of tone and hue shows significant differences [F (14, 210) =1.775, p = .04], which indicates that OCT pattern processed by color can affect the perceptions of news value. In addition, the sphericity tests have

been conducted on all data, and the data that does not match the Greenhouse-Geisser test or Huynh-Feldt test has been corrected.

In the dimension of news importance, as shown in Fig. 11-1, the main effects of hue show significant differences. Among them, only the mean value of YG color was under zero, i.e., negative in all, while the mean value of other hues was positive, which indicates that the news importance perception can be affected by the chromatic color processing in an OCT style. Concerning the multiple comparisons shown in the following, the effects of red were similar to blue, whereas it was significantly different from other colors, which indicates that blue can express the news importance at the same level the red does.

Regarding the orange color, it was stronger than YG color (t = 3.256, p = .039), while weaker than blue (t = -3.420, p = .029), and further without any significant differences with other hues. As primary color, yellow was only stronger than YG color in the news importance evaluation. Besides the above comparisons, YG color was also weaker than other hues, e.g., green (t = -3.550, p = .023), BG (t = -4.956, p <.001), and blue (t = -5.624, p <.001).

Green was significantly inferior to blue (t = -4.352, p = .003), but was similar to yellow. A significant difference between the BG color and the blue (t = -3.360, p = .032) was observed a significant difference. Blue was significantly different from purple (t = 4.667, p = .001). According to these comparisons, it reflects that the power of blue and red, i.e., the primary hues, is superior to the intermediate hues in news importance perception.

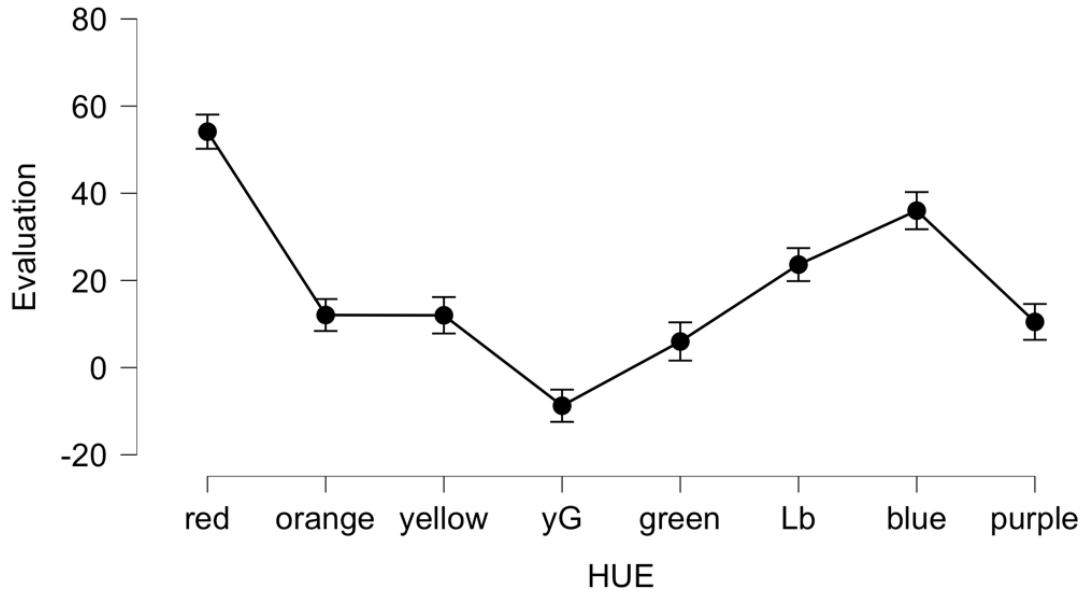


Fig. 11-1 | The main effects of hue on the news importance perception (***: p <.001; **: p <.01; *: p <.05, and the error bars represent SE in this research)

However, as shown in Fig. 11-2, the main effects of tone processing did not show any significant differences, only a slight difference was observed in the mean value. The expression of vivid tone was superior to the deep tone and the bright tone. As for within the specific news context, whether the tone manipulation can change the news value perception, would be continued to explore in the next experiment. It is worth noting that the mean values of these three tones were all positive, which indicates that no matter what tones can facilitate the perception of news importance in this condition.

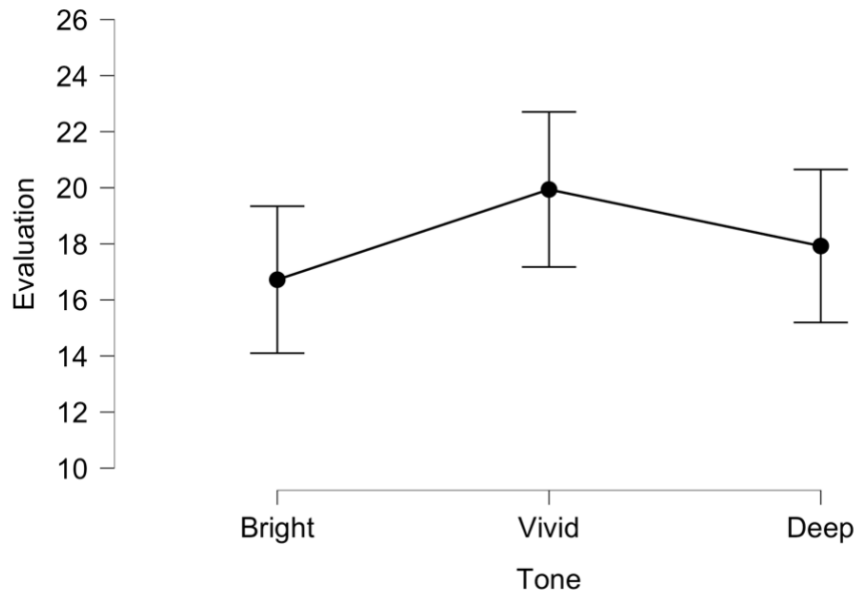


Fig. 11-2 | The main effects of tone on the news importance perception

The three lines that overlapped each other greatly presented the interaction between tone and hue as shown in Fig. 11-3, which reveals that the manipulation of OCT hue occupied a more important position in the perception of news importance than tone. Among the three broken lines, only the subtle differences were captured in the mean value of red and yellow, and other hues did not show in the mean value difference between the tone.

According to the multiple comparisons, the bright-toned red was only better than the same tone orange ($t = 3.900$, $p = .024$), purple ($t = 4.060$, $p = .013$), and deep-toned yellow ($t = 4.298$, $p = .005$). The performance of all toned YG color was significantly lower than the bright-toned red (Br. & YG, $t = 6.035$, $p < .001$; Vi. & YG, $t = 5.716$, $p < .001$; Dp. & YG, $t = 5.734$, $p < .001$), which can be understood as the extreme tone manipulation. The vivid green was also significantly weaker than the bright red ($t = 3.850$, $p = .03$). Therefore, even if the vivid tone performed slightly better on average, it was not better than the bright tone which is slightly inferior, which highlights the association between tone and news importance.

The power of vivid-toned red was significantly superior to almost all hues.

Specifically, the red was stronger than the same tone blue ($t = 3.841$, $p = .03$), but it did not show a significant difference with the bright and deep tone blue; thus, the manipulation of these blue and the vivid-toned red has the same effects.

Except for blue, there was no significant difference from the deep-toned red. The deep-toned red was observed a significant difference from the other colors, which once again proves the strong power of the red. It should be noted that the effects of red were similar to blue and bright BG color. This is the only place where there was a significant difference between red and blue. As the primary color, deep-toned yellow was worse than deep-toned blue, showing a significant difference ($t = -4.165$, $p = .008$).

The significant differences in the YG color were more often observed in comparison with the blue series, i.e., the BG color and blue, even the red. As we have seen, the bright-toned YG color was weaker than the BG color ($t = -4.236$, $p = .006$), while the YG color with vivid tone (Br. & BG, $t = -4.036$, $p = .014$; Dp. & BG, $t = -3.718$, $p = .049$) and with deep tone (Br. & BG, $t = -4.054$, $p = .013$; Dp. & BG, $t = -4.001$, $p = .016$) was significantly lower than the bright-toned and deep-toned BG color respectively. It can be observed that the YG color shows a counter-effect in the expression of news importance, and the BG color in the vivid tone was not suitable for the expression of news importance.

Between the bright toned green and blue ($t = -4.185$, $p = .008$), and between the bright-toned green and the deep-toned blue ($t = -4.127$, $p = .01$), the significant differences appeared. But similar to the BG color, the differences between blue and green was without significant difference in the vivid tone, which indicates that the hue is not the only factor that affects the news importance while the tone also plays a role in it.

In summary, through the perception of news importance, the active effects of hue have been clarified. Especially the hues, e.g., the red and blue have stronger effects compared with the performance by YG color. Also, the effects that were mainly observed in the intermediate hues were limited relatively.

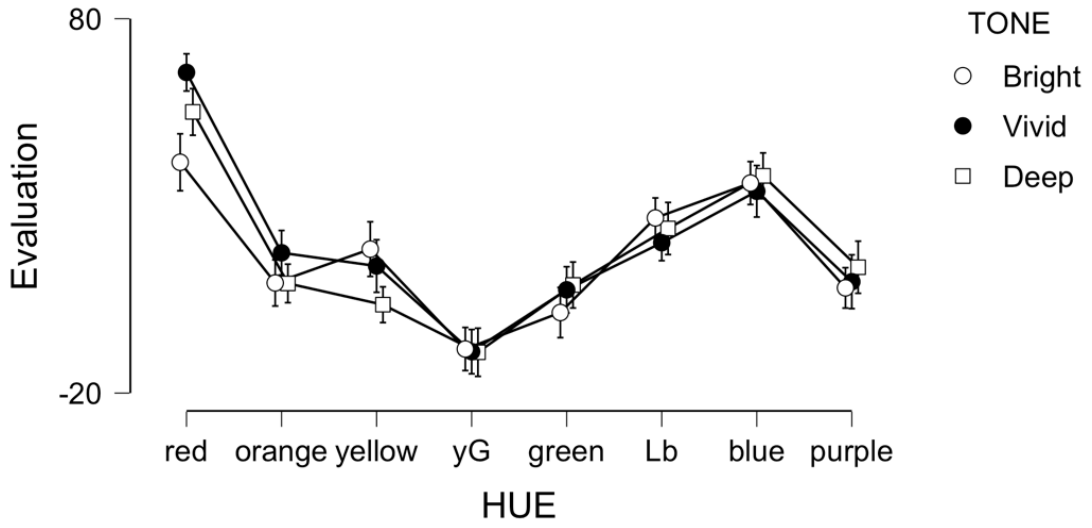


Fig. 11-3 | The interactions between tone and hue on the news importance perception

In the perception of news novelty dimension, as shown in Fig. 12, through the OCT coloring manipulation, the judgments to news novelty under different color conditions have changed. As we have seen, the main effect of tone (F [2, 60] = 31.462, p <.001) and hue (F [7, 210] = 4.382, p <.001], and the interaction between them (F [14, 420] = 3.129, p <.001] significantly differed.

Specifically, as shown in Fig. 12-1, the main effect of hue processing shows significant differences among the selected hues. These significant differences were mainly concentrated between the red, yellow, green, and blue series. The red (t = 4.454, p = .003), blue (t = 3.412, p = .047), and green (t = 3.597, p = .03) was better than BG color respectively. Red was also greater than blue (t = 3.412, p = .047). It can be observed that although the blue series performed positive effects in the perception of importance, it shows the complete opposite result in the perception of novelty. By contrast, the YG color shows a superior effect compared with other intermediate colors in this dimension, and it was also opposed to the performance in the importance dimension.

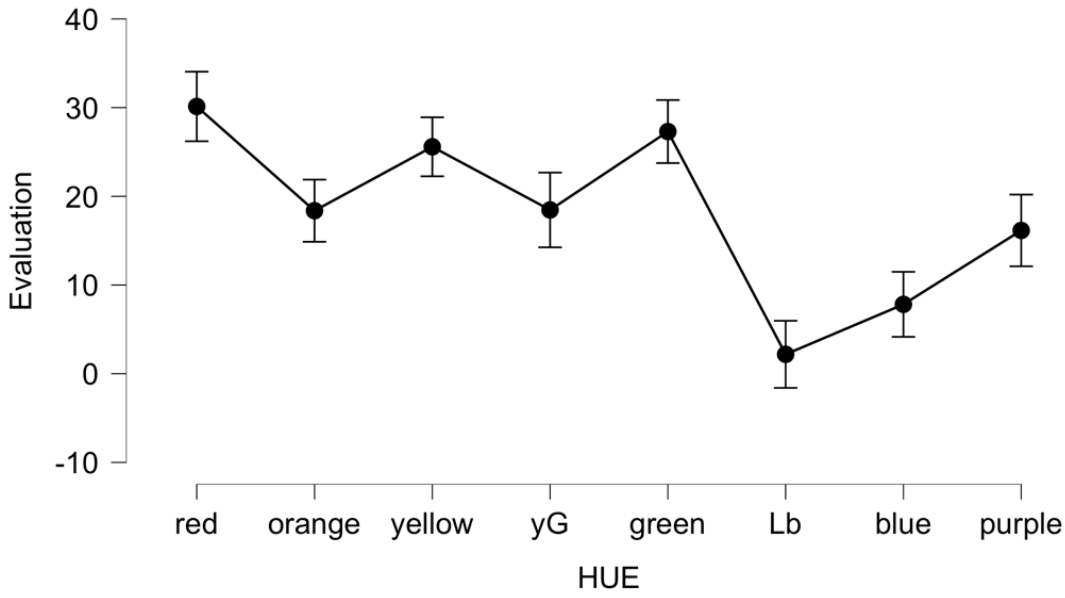


Fig. 12-1 | The main effects of hue on the news novelty perception

From the perspective of tone manipulation, the mean value of the three tones was higher than zero as shown in Fig. 12-2, which indicates that the color tone processing made the news perceive more novel, i.e., visual fresh than the control condition. Specifically, the bright tone had the best effect, followed by the vivid tone, and the worst was the deep tone. The significant differences were that the bright tone condition was better than vivid tone condition (t = 3.615, p = .001) and deep tone condition (t = 7.822, p <.001) respectively. Also, the vivid tone condition was stronger than the deep tone condition (t = 4.264, p <.001). It can be observed that whether the news is perceived as novel or not was largely related to the factor of the tone. The physical parameters of tone as brightness and chroma, i.e., the bright tone with higher lightness and higher saturation, the vivid tone with the harmony of the highest lightness and chroma, and the deep tone with lower lightness and higher saturation reveal that higher brightness may influence the perception of the news novelty.

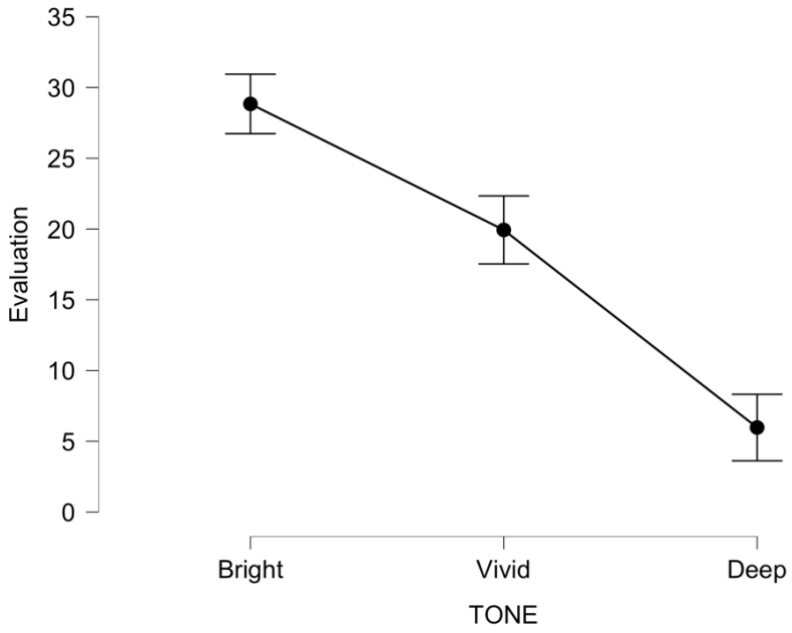


Fig. 12-2 | The main effects of tone on the news novelty perception

A significant difference was observed in the interaction between hue and tone as shown in Fig. 12-3. Except for green, the mean value of the remaining hues with a bright tone was the highest. The mean value of vivid tone in most hues except green was basically at the middle position, although there were exceptions, e.g., the blue series. Most hues had the lowest mean value within the deep tone condition. According to the multiple comparisons, the bright-toned red was significantly different from the three intermediate colors, i.e., the deep-toned orange ($t = 4.020$, $p = .017$) and purple ($t = 3.772$, $p = .043$), and the BG color in the vivid ($t = 4.618$, $p = .001$) and deep ($t = 4.625$, $p = .001$) tone condition. However, there was no significant difference between the bright red and the YG color, which can be understood as the same effects. It can be seen that the YG color as an intermediate hue has similar effects with other intermediate colors.

There was a significant difference between the vivid-toned red and the deep-toned orange ($t = 3.873$, $p = .03$), which indicates that the deep-toned orange is difficult to make news perceive novel. Besides, the effects of vivid-toned red (Vi. & BG, $t = 4.613$,

p = .001; Dp. & BG, t = 4.478, p = .002) and deep-toned red (Vi. & BG, t = 3.764, p = .044; Dp. & BG, t = 3.892, p = .028) were better than the vivid-toned and deep-toned BG color, respectively. Combining Fig. 12-3, the BG color within the vivid tone and deep tone conditions was at the lowest position in the graph, which reflects that it is difficult to be brought for news novelty into play.

Regarding the orange color, the bright tone was higher than its deep tone (t = 5.629, p <.001). This phenomenon was not only limited to the orange color, but also the same was true for the remaining intermediate hues, i.e., YG (t = 4.877, p <.001), BG (t = 3.744, p = .048), purple (t = 4.574, p = .002), which suggests that the tone for intermediate hue has an essential influence on the perception of news novelty. By contrast, regardless of the mean value, as primary hues, when changing of the tone manipulation happened to the red and blue, the perception in this dimension will not be affected. The bright-toned orange was significantly superior to the deep-toned YG (t = 3.884, p = .028), BG (t = 4.788, p <.001), and purple (t = 3.935, p = .023), and was significantly better than the vivid-toned BG color (t = 4.781, p <.001). As for the deep-toned orange color, it shows weaker than the bright-toned yellow (t = -5.009, p <.001), YG color (t = -3.923, p = .024), green (t = -3.962, p = .021), and the vivid-toned yellow (t = -3.795, p = .04) and green (t = -4.350, p = .004). Thus, considering the orange color, the YG color series formed a sharp contrast with it, which also implies that the YG color series can facilitate the perception in the news novelty.

Concerning the yellow, there was no difference within the bright and vivid tone, but bright (t = 5.916, p <.001) and vivid (t = 4.282, p = .006) tones were significantly stronger than its deep tone. Also, the bright-toned yellow was better than the deep-toned YG color (t = 4.711, p <.001), purple (t = 4.761, p <.001), and stronger than the vivid-toned BG color (t = 5.607, p <.001), deep-toned BG color (t = 5.615, p <.001), and greater than blue within all tones (Br., t = 3.796, p = .04; Vi., t = 4.129, p = .011; Dp, t = 4.214, p = .008). It can be judged that the blue series may be difficult to highlight the news novelty. By contrast, the association between brightness and novelty was further confirmed, since the bright-toned yellow shows the highest mean value among all conditions, and the yellow hue which is with the highest brightness is known in fact.

The vivid-toned yellow was roughly similar to its bright tone, while the deep-toned yellow was almost as same as the other deep-toned hues, i.e., at a lower level, and it performed a little significant difference to the vivid-toned green (t = -3.737, p = .049). The mean value of the vivid-toned green was higher than its bright tone condition, and it has the highest mean value in the overall hues within this tone, which suggests that news novelty may be associated with the fresh hue always seen in the natural world.

Besides, it is worth noting that there was a significant difference between the bright-toned YG color and the BG color within the vivid and deep tone, which is the opposite of the importance dimension. Others, such as green, were significantly different from BG color.

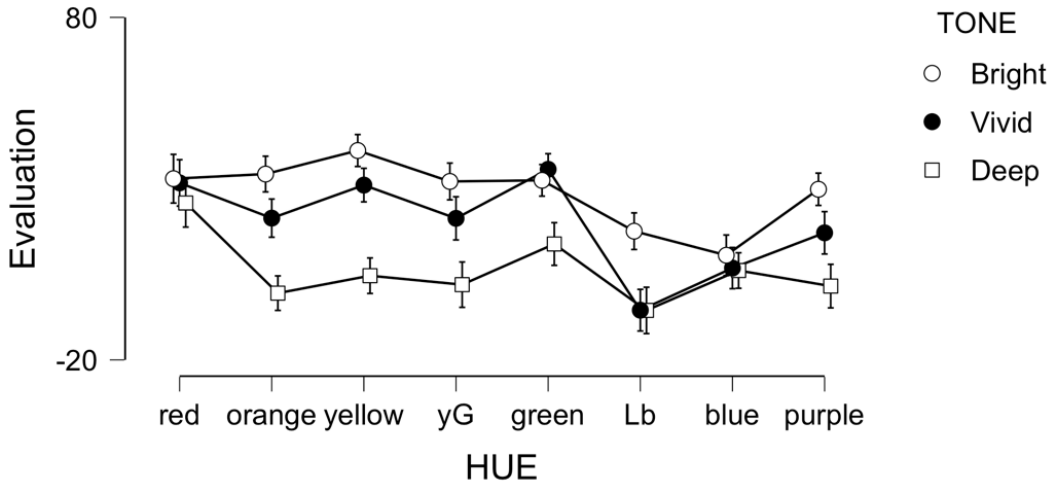


Fig. 12-3 | The interactions between tone and hue on news novelty perception

Regarding the dimension of news timeliness, the main effects of tone (F [2, 60] = 20.303, p <.001] and hue (F [7, 210] = 13.322, p <.001) manipulation show significant differences. Also, the interaction between these two factors was significantly different [F (14, 420) = 3.589, p <.001], which suggests that the color processing on OCT influenced the expression of news timeliness.

First, the main effect of hue as shown in Fig. 13-1, the performance of hue

presented a state of ups and downs, i.e., colors such as red, yellow, green and blue, was at a relatively high position. While the performance of orange, YG, BG, and purple was at a relatively low position. Red was significantly higher than other colors. As it has shown, all of the colors which were at the higher position belonging to the primary hue, and all of the colors which were at the low position belonging to the intermediate hue. Therefore, significant differences can be observed between primary hues and intermediate hues. Specifically, significant differences can be captured between red and the other colors, which indicates that red can make news perceived more time-sensitive. Besides, significant differences between the orange color and yellow (t = -3.663, p = .018); yellow and YG color (t = 3.644, p = .018), purple (t = 4.200, p = .005); YG color and green (t = -3.300, p <.04); green and purple (t = 3.624, p = .018); blue and purple (t = 4.091, p = .007) were clearly observed.

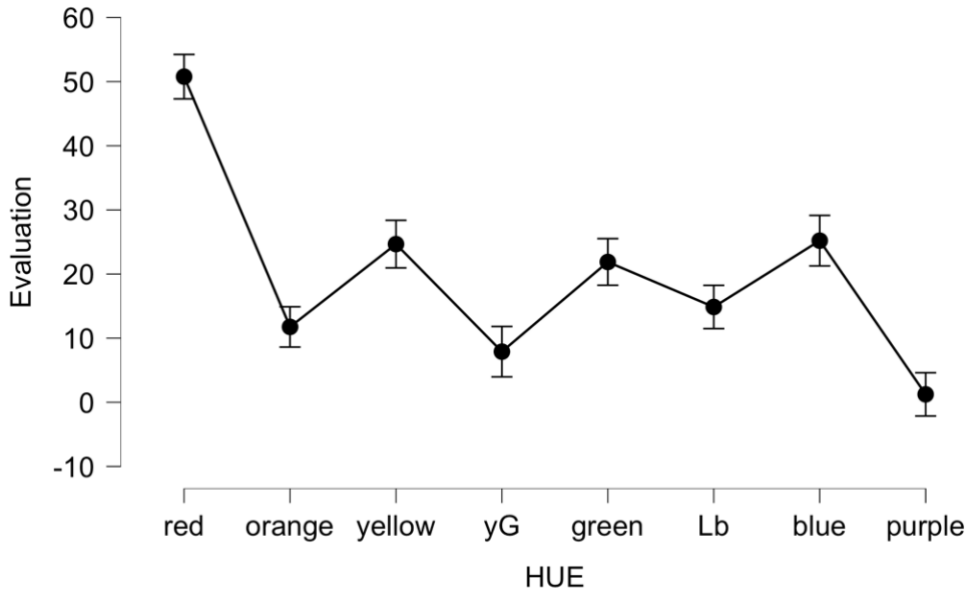


Fig. 13-1 | The main effects of hue on the news timeliness perception

Concerning the main effect of tone, the news timeliness tended to the bright tone. Its performance was similar to the novelty dimension, but the difference is that the

bright tone and vivid tone were considered to have the same effects. There were significant differences that bright tone (t = 5.515, p <.001) and vivid tone (t = 4.287, p <.001) were greater than deep tone respectively. It can be seen that the news timeliness also has a stronger association with the brightness, i.e., one of the attributes of tone.

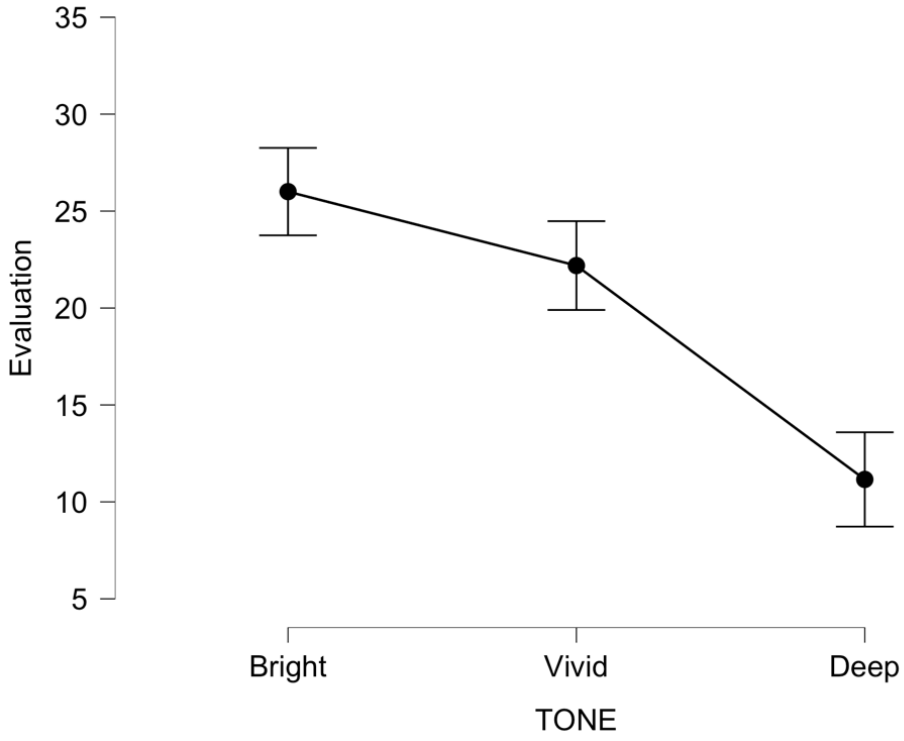


Fig. 13-2 | The main effects of tone on the news timeliness perception

Concerning the interaction of hue and tone, the overall trend was stepped down and there were obvious differences within tone in the yellow and YG color as shown in Fig. 13-3. The tonal effects between other colors were similar to the importance dimension, i.e., there were differences but not significant. Specifically, the bright-toned red which had the lowest mean value within its hue was greater than the deep-toned yellow (t = 6.026, p <.001) and green (t = 4.415, p = .003); better than the remaining intermediate colors with the bright tone, i.e., YG (t = 3.767, p = .038), BG (t = 3.775, p

= .037), purple (t = 5.959, p <.001) except for orange color, which suggests that the bright orange color has the same effects as the red with the same tone in terms of temporal perception.

Besides, the vivid-toned red had a higher significant difference with the bright orange color (t = 4.081, p = .011) and green (t = 3.915, p = .022), and blue with vivid (t = 4.213, p = .007) and deep (t = 3.869, p = .026) tone. Although the primary color was better than the intermediate color as a whole, the partial primary colors still show a certain gap with the red due to the tone effects. The deep-toned red was almost the same as the vivid-toned red. In summary, the red can effectively facilitate the news timeliness.

Regarding the yellow, significant differences in the hue (Br. & Dp., t = 6.476, p <.001; Vi. & Dp., t = 4.643, p = .001) can be observed as very different by the tone level. The bright-toned yellow was not inferior to red, while deep-toned yellow was almost at the same level as the YG color within the same tone, which reveals the significance of tone for yellow. Also, bright-toned yellow was better than the deep-toned YG color (t = 6.755, p <.001), and the vivid-toned BG color (t = 3.886, p = .024) respectively.

Besides, the vivid-toned yellow was greater than the deep-toned YG color (t = 5.293, p <.001) and the purple (t = 4.431, p = .003) respectively. By contrast, the deep-toned yellow was worse than the bright blue (t = -4.019, p = .015). It suggests that the most intermediate colors with deep tone are not appropriate to the expression of news timeliness.

Moreover, no matter whether the vivid-toned green (Dp. & purple, t = 4.273, p = .005) or bright-toned blue (Br. & purple, t = 3.931, p = .021; Dp. & purple, t = 4.748, p <.001), there were only differences between the purple except the vivid tone. Combining with its mean, it can be considered that the purple was also at a low position even in the cool color series.

Concerning the intermediate hue, it was inferior to the primary hue as a whole. Specifically, the bright-toned orange was better than the deep-toned YG (t = 4.057, p = .013). The deep-toned orange was weaker than the bright-toned yellow (t = -5.348, p

<.001), bright-toned blue (t = -4.202, p = .007), and worse than the vivid-toned yellow (t = -3.886, p = .024) and green (t = -3.727, p = .044). Also, there were significant differences in the YG color within its three tones (Br. & Dp., t = 4.878, p <.001; Vi. & Dp., t = 4.079, p = .012); thus, the tone factor can influence the perception of news timeliness. Besides, BG as an intermediate hue is quite satisfactory because of its smaller deviations and the passable mean value. The performance of purple was relatively stable since the its lower position.

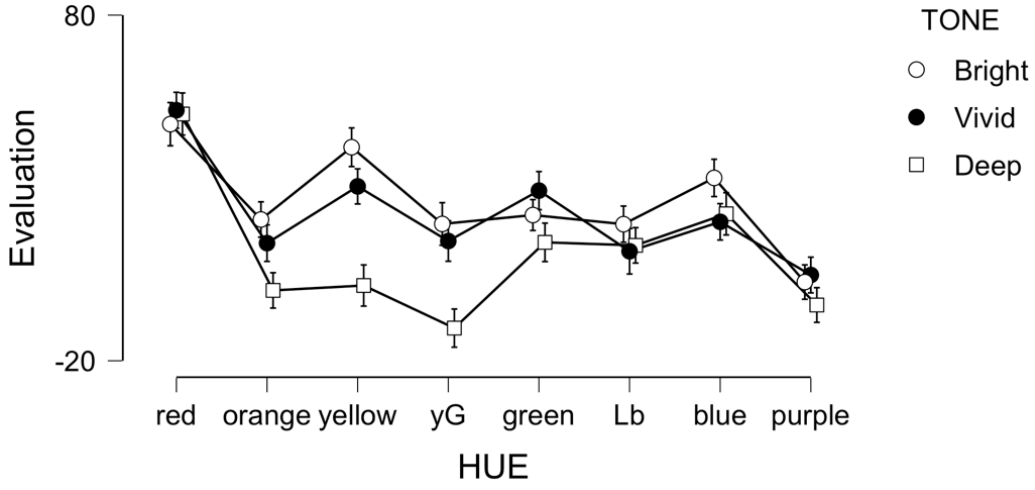


Fig. 13-3 | The interactions between tone and hue on the news timeliness perception

2.4 | Discussion

According to the results, compared to the non-color condition, the OCT pattern manipulated by color can influence the news value perception. The influences include the positive effects, i.e., facilitating the news value perception, and the negative effects, i.e., inhibiting the original news value owned. In the cognitive evaluation, the great individual differences were observed on the different news value dimensions in terms of the factors formed by hue and tone. Benjamin H. Detenber et al. investigated the

emotional effects of color on television presentations, and its results indicated that the influence of color appeared in the self-reports of emotional experience, but out of the physiological measures (skin conductance, heart rate, and facial electromyography), which suggests that people feel, or consciously believe they feel, that color pictures are more pleasing and exciting than monochrome versions of the same images, yet there is no difference in their physiological responses.[6] Concerning this, the null hypothesis cannot be valid, i.e., the OCT color manipulation can indeed influence the perception of news value in the latent news context.

The cognitive mechanism of news value can be interpreted from the perspective of hue and emotion. Patricia Valdez and Albert Mehrabian reported that long-wavelength colors (e.g., red and yellow) are more arousing than short-wavelength colors (e.g., blue and green).[69] Experimental studies that have used physiological measures (e.g., GSR, EEG) generally have shown that red and yellow are indeed more arousing than blue and green. In this experiment, especially the light-toned yellow is the highest in the evaluation of novelty, while the blue color occupies the top position in the importance evaluation, which is highly consistent with that insight. Red, as mentioned in the previous study, has significant effects in most cases. Thus, it can be said that the long-wave color has the physiological characteristics of high visual arousal, which suggests its ability of expression for novelty. Red and blue can both indicate the importance of news, which reflects that the importance is not only related to the arousal ability of color but also affected by other factors e.g., color-orthodox consciousness. Participants reported that OCT colored by blue and red can make news perceived more important. The so-called orthodox, i.e., the meaning of correctness and orthodoxy, is the definition of the cultural attributes of color, and this is also in line with the news context.[4] The orthochromatic colors can be roughly equivalent to primary colors or basic colors. Although there is no report that the news timeliness was affected by orthochromatic consciousness, the findings imply that the timeliness same as the importance dimension may be also affected by the orthochromatic color consciousness.

[4] 「正色」の選択肢❶。昔、中国では、まじりけなく正しいと定めた色。青・黄・赤・白・黒の5色。広辞苑（第六版），岩波書店 2008,2014。

From the perspective of tone preference, there seems to be some insights that can support the results of this experiment. Guilford and Smith found that brighter and more saturated colors can elicit greater pleasure.[20] The perception for news novelty has a stronger bright tone tendency. Although the novel and pleasure have different meanings, both of them generally indicate the positive direction. By extracting the brightness data from selected colors in the HSP[5] (Hue, Saturation, Perceived brightness) color model, the coupling diagram between the mean value of the news novelty evaluation and brightness data was plotted. It can be observed that as the tone changes from lighter to darker, the engagement between them gradually decreasing. Among them, the bright tone shows the best engagement, which reveals the influence of lightness on news novelty perception.

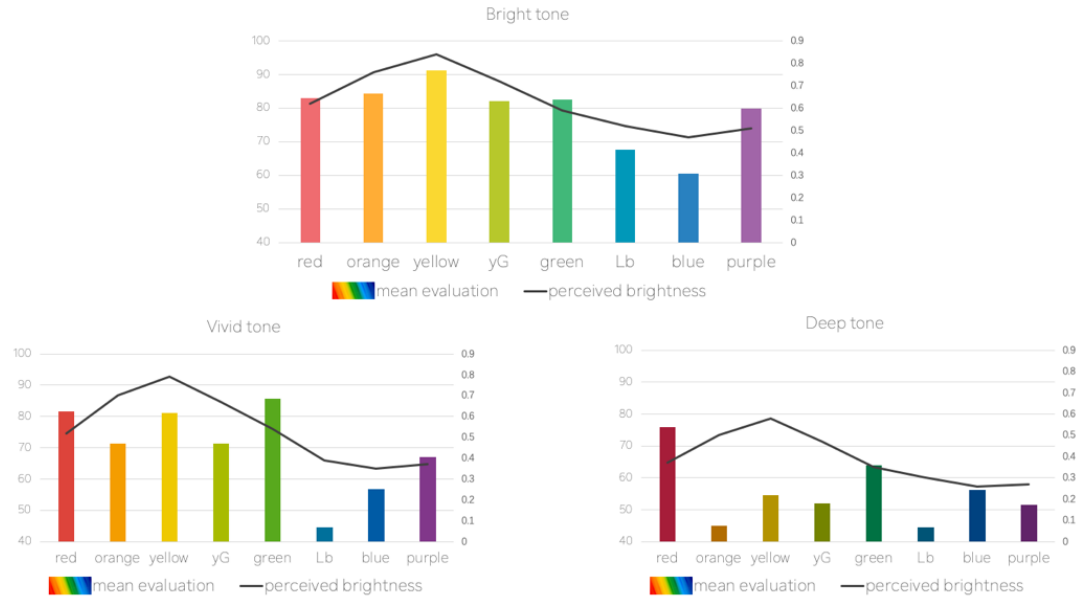


Fig. 14 | The coupling extents between the lightness (right vertical axis) and the mean value (left vertical axis) of news novelty evaluation

Besides, it is worth noting the performance of partial intermediate hues. For

[5] Source from, https://encycolorpedia.cn

example, previous studies have pointed out that YG color can cause visual disgust because it looks visually reminiscent of vomit. In this experiment, especially in the dimension of news importance evaluation, the mean value of the importance evaluation for YG color is negative, which is consistent with this insight. However, in other news value dimensions, the performance of YG color did not appear to be extreme and was roughly at a normal level, and the overall evaluation for dark tone is lower than that of light tone, which suggests that specific issues are required to specific analysis. Also, khaki green which is used as one of the military camouflage colors is studied in the optimization research for the hidden function, because its appearance is similar to the YG color especially within the dark tone.[32]

The OCT manipulated by purple is generally difficult to be judged its ability to perceive the news value, i.e., it is similar to the control condition or the individual differences in above analysis. To a large extent, purple reflects the social opinion, e.g., it can symbolize imperial power, mystery, and so forth. For news, this deviates from the truth and certainty required by the news. Purple is the color that is the most associated with ambiguity. As interpreted, an intermediate hue is generated by the two primary hues; thus, it is seen as uncertain and equivocal. In addition, the perception of news value relies more on individual interpretation rather than collective consciousness, although there are indeed some consistent insights for partial aspects.[4][29]

CHAPTER 3

| The effects of OCT hue on perception of news value in the emotional context

3.1 | Introduction

In this section, the issue that whether the hue of the OCT can change the perception of news value in the news emotional contexts has been explored, i.e., whether the OCT manipulated by different color appears in the actual news scenes can change the news value perception. Correspondingly, the research questions would be proposed as below.

RQ1: In reality, the content and categories of news are diverse, but whatever the news is, its content must contain a certain emotional orientation, e.g., news about disasters such as earthquakes, news about positive emotions such as support, and news about other emotions that are not quite clear. Thus, is it possible to process the OCT hue to manipulate viewer's perceptions of value of news? In other words, does the change of OCT hue in news scene affect viewer's perception of the value of news scenes? If there are influences, are there differences in perceptions about the news value between different hues? Are these differences significant?

RQ2: Can a single hue appropriately integrate different news value dimensions simultaneously within the same news scene? Do all hues have the ability to do this in different news emotional contexts? If it is, are there differences in the integration of news value between hues? Are these differences significant?

3.2 | Method

3.2.1 | Stimuli

Regarding the news scenes, i.e., the news emotional contexts, the news images were randomly selected based upon their basic emotions (Fig. 15 - Fig. 17). But

whatever the kind of news is, i.e., the soft news or hard news, it has the objective (non-subjective) nature of news facts and emotions.

In the preparatory investigation stage of this research, twenty-four news terms that covered the different categories of news were used, each of which has a clear meaning and objective emotional tendencies. Then, their emotional tendencies were judged by the eighteen participants. Even for the same news term, different people may have different psychological feelings and emotional judgments. For example, in the scene of a *disaster*, about 88% of participants considered it as news with negative emotion, and about 12% of participants thought it was just a piece of general news. About 38% of participants regarded the news scene *transaction* as news with positive emotion, whereas about 62% of people rated it as just a piece of general news. In the news scene of *support*, about 83% of participants considered it as news with positive emotion, and about 6% of people rated it as a piece of general news, whereas the remaining 11% of participants thought it was negative news. Thus, although most news is comprehended as with different emotions in the consciousness of the overall social viewers, there still have a certain emotional cognitive tendency.

Therefore, the study is based on the dominant emotional tendency of the news scenes themselves, i.e., the emotional judgment of a news scene was agreed upon by more than half of the participants. In other words, the understanding that more than 50% of participants considered the disaster scene as negative news and considered the transaction scene as neutral news and considered the support scenes as positive news was adopted.

Fig. 15 | The disaster scene (negative emotional tendency). Japan Meteorological Agency, Kumamoto earthquake received without using aftershocks for earthquake prediction.[6]

Fig. 16 | The transaction scene (neutral emotional tendency). Picasso's "crying woman" wins one billion Yen "the highest price" in a domestic auction.[7]

[6] https://www.nikkei.com/article/DGXLASDG19H6T_Z10C16A8MM8000/
[7] https://www.asahi.com/articles/ASL627RV3L62UCLV009.html

Fig. 17 | The support scene (positive emotional tendency). Reconstruction assistance for typhoon No. 19 disaster area X TEAM donation.[8]

The images were selected to be as close to the actual news as possible; thus, the color using of these images was not deliberately homogenized. In this statement, none of the selected images infringed on the intellectual property rights of the owner of the pictures. None of the participants in this and subsequent experiments reported that the pictures caused physical or psychological discomfort, and the use of images conformed to the ethics of psychological research, i.e., it is the duty of the physician to promote and safeguard the health, well-being and rights of patients, including those who are involved in medical research. The physician's knowledge and conscience are dedicated to the fulfilment of this duty.[9]

The hues of OCT were selected from the hue ring of PCCS (Fig. 18), which is an arrangement of the highest saturated colors of the 24 hues in such a way that they perceptually shift to equivalent paces. The hue employed in this experiment, the four primary hues (2: R, 8: Y, 12: G, and 18: B) and four intermediate hues (5: O, 10: yG/YG, 15: Lb/BG, and 22: P) were selected. The color samples employed in the OCT pattern were calibrated by chromatic photometers (Minolta, CS-100; Minolta, CA-100). To ensure the harmony of visual discrimination on screen, the character carrying parts were

[8] https://www.gamba-osaka.net/news/index/no/10402/

[9] 4th item of general principle from the DECLARATION OF HELSINKI. Ethical Principles for Medical Research Involving Human Subjects.

colored white with 5% transparency. Regarding the caption texts, the *earthquake*, *transaction*, and *support* were adopted to correspond to the negative, neutral, and positive emotional contexts. The font is Gothic and colored pure black. Because of the subtle expression differences between the Chinese and Japanese languages, the transaction scene is represented as the following notations, i.e., the CHENGJIAO in Chinese, and the RAKUSATSU in Japanese. In addition, a news icon was designed to indicate the news channel, set on the upper right corner of the screen NEWS.

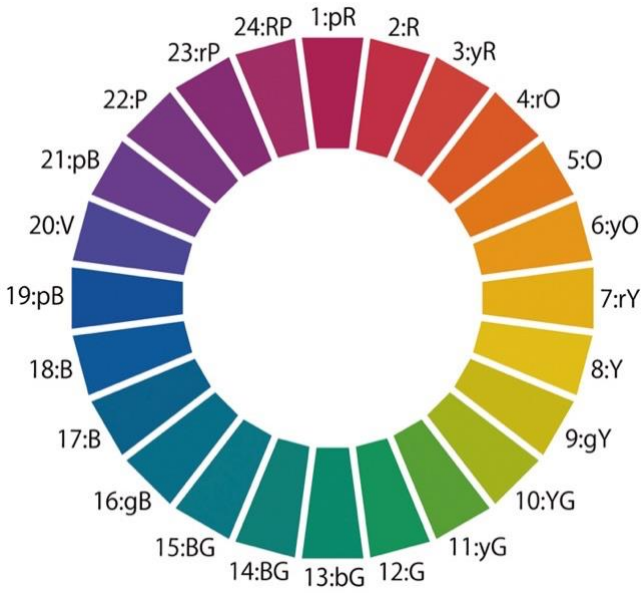


Fig. 18 | The PCCS hue ring. The image copyright of this PCCS hue ring belongs to the owner of its creator. The original idea copyright of the PCCS hue ring belongs to the Sikiken Corporation.

3.2.2 | Participants

Twenty-two participants were recruited. There were eleven males and eleven females (22–46 years, $M = 29.18$, $SD = 4.40$). Of all participants, fifteen people indicated that they had never participated in similar experiments before. Seven people

indicated that they had participated in psychological experiments before, including four people that they had participated in experiments similar to the current experiment more than twice, and the remaining three indicated that they had hardly participated in experiments similar to the current experiment before.

Of all participants, seventeen people indicated that they participated in this experiment by wearing colorless and clear myopic glasses, and all of them indicated that they wore myopic glasses on a daily basis. All participants who wore glasses were asked to make sure that the lenses are clear and non-tinted during the experiment. Wearing other eyewear other than for vision correction, including but not limited to sunglasses, etc., was not acceptable in this experiment. Regarding color vision, all participants indicated that they had previously been given and passed the Ishihara test. Thus, all had normal or corrected-to-normal visual acuity and color vision. The participants were provided with informed consent at the beginning of the experiment.

3.2.3 | Apparatus and Experimental Environment

An 11.6" LED display (APPLE, MacBook Air) manufactured in 2015 was used. Its screen has a native resolution of 1920 × 768 (16:9 aspect ratio).[54] PsychoPy 3 (an open-source software) was used for stimulus presentation. Besides, the experiment was conducted indoors, with the curtains closed during the experiment period. Adjustable LED ceiling lights were used with a color temperature of 5000K.

The ceiling light can ensure that the color rendering is not easily interfered with by the light source. Participants were asked to check the lighting condition before the experiment. The participants were required to complete the experiment independently; thus, temporarily adjusting their mobile phones and other information terminals to silent mode during the experiment was required. The experiment needs roughly 30 minutes.

3.2.4 | Procedure

A new scale adopted in this section was similar to the former experiment, but the operation is different. The evaluation object in the former experiment was the OCT pattern itself, which does not involve the actual news contexts. The object in this experiment was three specific news scenes as introduced previously. The value of original news images, i.e., without the color OCT, was assigned to 50; thus, the evaluation scale containing negative values which was used in the former experiment was re-adjusted to all-plus values scale, i.e., the evaluation scale was changed from -100–0–100 (minus 100 represented that the news value was completely inhibited; the ZERO in the medium represented for not sure; plus 100 represented that the news value was fully facilitated) to the 0–50–100 (zero represented that the news value was completely inhibited compared with the value of the non-manipulated news scenes; the 50 in the medium represented for the original news value of the selected images; 100 represented that the news value was fully facilitated compared with the value of the non-manipulated news scenes, i.e., 50) (Fig. 19).

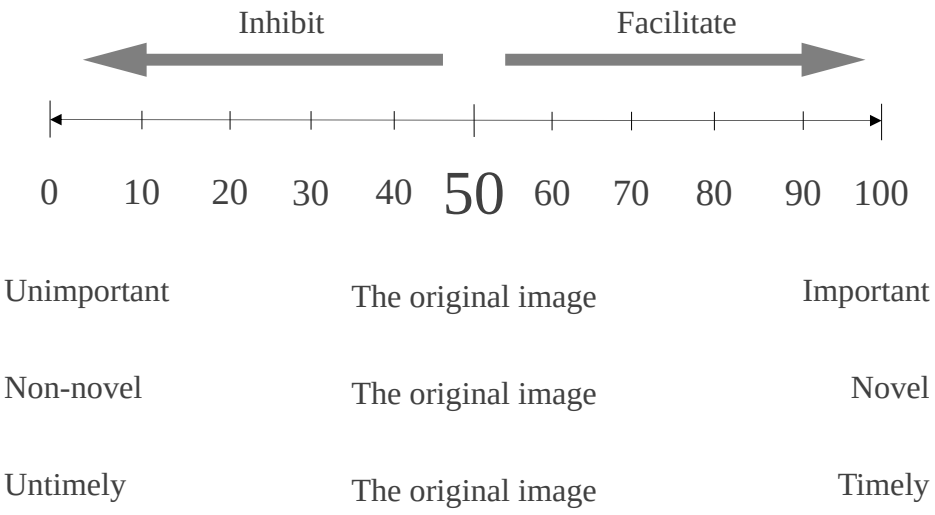


Fig. 19 | The evaluation scale, i.e., 0–50–100 employed in this section

First, the participants were instructed that the distance between their eyes and the screen was set to 60 cm. Then, start PsychoPy 3 and begin the experiment program. A personal information dialog box appeared on the screen, including age, gender, and nationality. After answering, the descriptive information about the experiment appeared, saying look at the following news scenes, in comparison with the reference images, has the importance, novelty, and timeliness of these news scenes changed? Please evaluate according to the instructions.

Next, the evaluation scale appeared on the screen, and its instructions on how to use this scale appeared above the OCT pattern, i.e., click, and hold the left mouse button and drag the blue inverted triangle in the center of the scale to choose the value. The number was displayed in the box below the scale. After deciding, click the number in the box. Press the spacebar to enter the next step.

Thereafter, participants were asked if they wanted a test trial. If it is, press the Y button to enter the test trial, otherwise press the spacebar to enter the formal trial. After pressing the spacebar, as shown in Fig. 20, a fixation cross appeared, and about 1000ms later, the stimulus news image appeared on the screen, i.e., one of the three news images

appeared randomly accompanied by an uncolored OCT with the value of 50 at the bottom. After 500ms, the same news scene was reproduced and accompanied by a chromatic colored OCT (see Fig. 21), and the evaluation scale appeared at the bottom of the same screen. The participants were instructed to evaluate the items by the scale, and there was no limit on reaction time. The number shown in the box was recorded. The above was one formal trial. After all the news scenes with nine hues had been evaluated (3 news images × 9 hues × 3 news value dimensions = 81 trials), the program automatically ended.

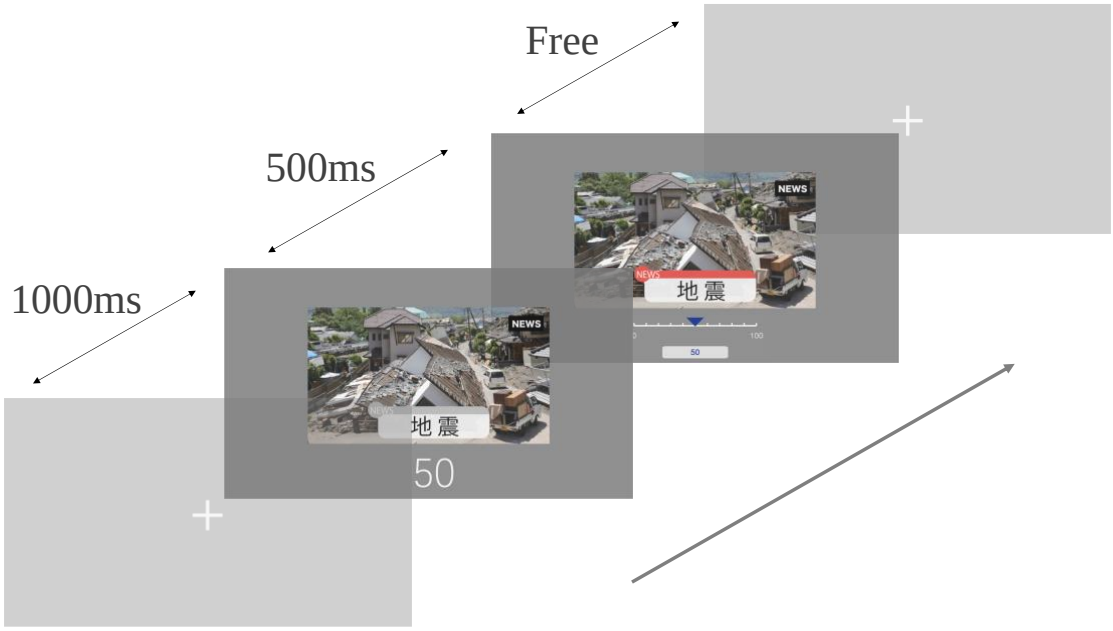


Fig. 20 | The process conducted in the experiment

Fig. 21 | The example of the actual trial in this experiment

3.3 | Results

3.3.1 | The performance of hue on the perception of news values in the emotional contexts

The main effects of hue had significant differences (F [8, 168] = 9.56, p <.001), and the interaction between context and hue shows significant differences (F [16, 336] = 10.17, p <.001]. As shown in Fig. 22, except for partial hues, most hues enhanced the news importance in the emotional contexts.

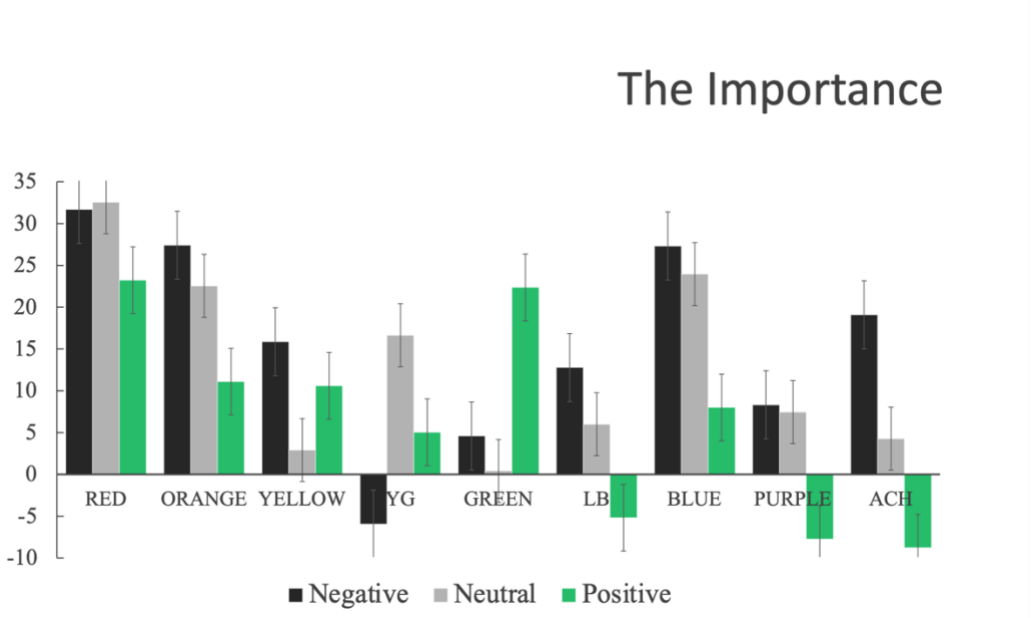


Fig. 22 | The perception of news importance in the emotional contexts

Through the multiple comparisons, as shown in Fig. 23, primary colors facilitated in different levels on the news importance in three emotional contexts. As shown in the upper left of Fig. 23, red was positively evaluated in all contexts, but a significant difference was not observed between them. Conferring the former experiment, it once again shows that red was stable when indicating news importance. As shown in the upper right of Fig. 23, yellow facilitated the awareness of news importance in the three emotional contexts, although there was no significant difference between the contexts, it was found by comparing the mean value that compared with the neutral context, yellow highlighted the news importance in the positive and negative contexts, with obvious emotional tendencies.

Regarding green and blue, a significant difference was observed in specific contexts. For example, the green, the performance of positive context was stronger than negative context (t = -4.15, p = .012) and neutral context (t = -5.13, p <.001). The performance of the neutral context was similar to the control group. The mean value of blue was similar to red, which the performance was significantly stronger in the negative context than in the positive context.

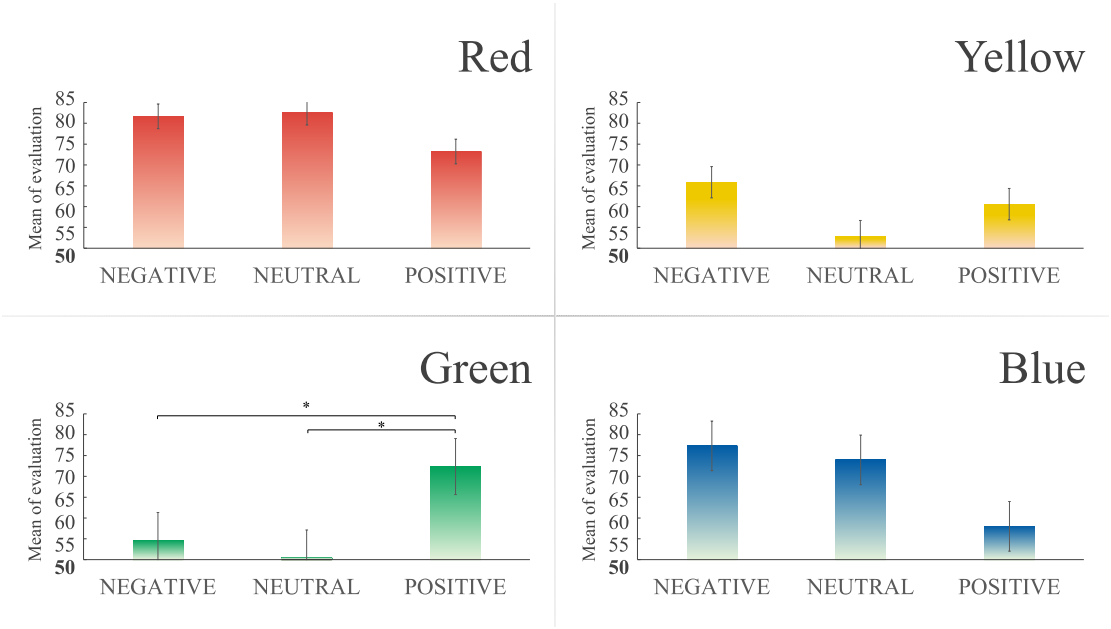


Fig. 23 | The evaluation of news importance with emotional contexts in primary hues

The intermediate colors (Fig. 24) in various contexts reflected their diversified characteristics. Except for the orange color, the other three hues inhibited the new importance in the specific context, e.g., the negative context with YG color OCT, and the positive context with BG and purple color OCT. Compared to the primary hue, the intermediate hue had a clear orientation for the news importance combined with specific contexts. Considering the mean value, the orange hue as a whole exceeded 60, which was close to the primary hue in a relatively dominant position. With the exception of the purple condition, the contexts with the other three hues OCT show significant differences in the perception of news importance. For example, the negative context with orange color OCT was stronger than that of the positive context ($t = 3.81$, $p = .043$). The YG color OCT in the neutral context was significantly better than that of the negative context ($t = 5.28$, $p < .001$). Compared with the positive context, BG color was more suitable for the negative context ($t = 4.20$, $p = .01$). Although Purple indicated a certain tendency in the emotional context, yet there was no significant difference

observed between the contexts. Thus, purple OCT for news importance indication was limited. In summary, most intermediate hues were not suitable for the news importance expression in this condition.

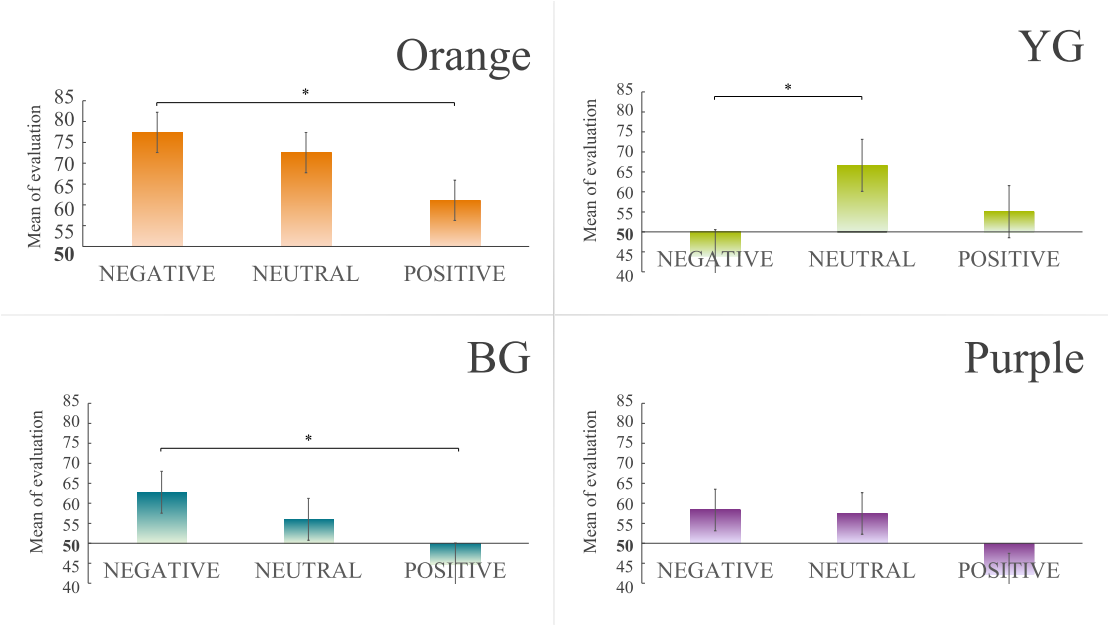


Fig. 24 | The evaluation of news importance with emotional contexts in intermediate colors

As shown in Fig. 25, the news scene with achromatic OCT was highly evaluated in the negative context, followed by the neutral, and negative evaluation in the positive context, and a significant difference was observed between the positive and negative context (t = 6.51, p <.001). Achromatic color can make news in the positive context perceived far less important than news in the negative context.

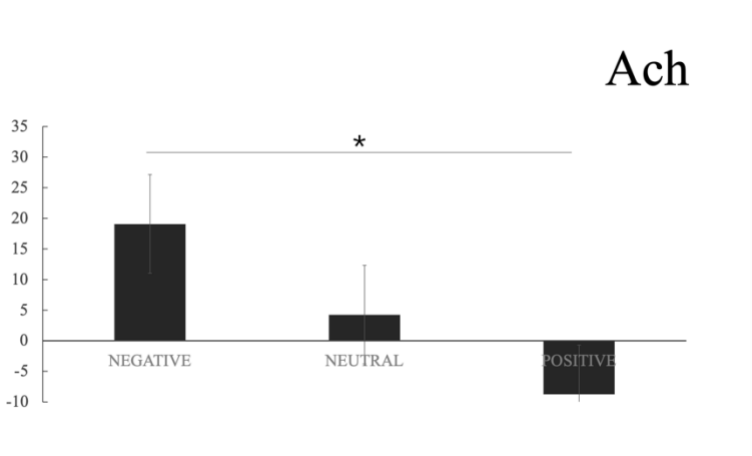


Fig. 25 | The evaluation of news importance with emotional contexts in achromatic color

With regard to the news novelty, except for the blue series and black, the OCT with other colors can make the news perceive more novel (Fig. 26). Based upon the ANOVA, the interaction between the factors of hue and emotional context shows a significant difference in the perception of news novelty (F [16, 336] = 2.13, p = .007).

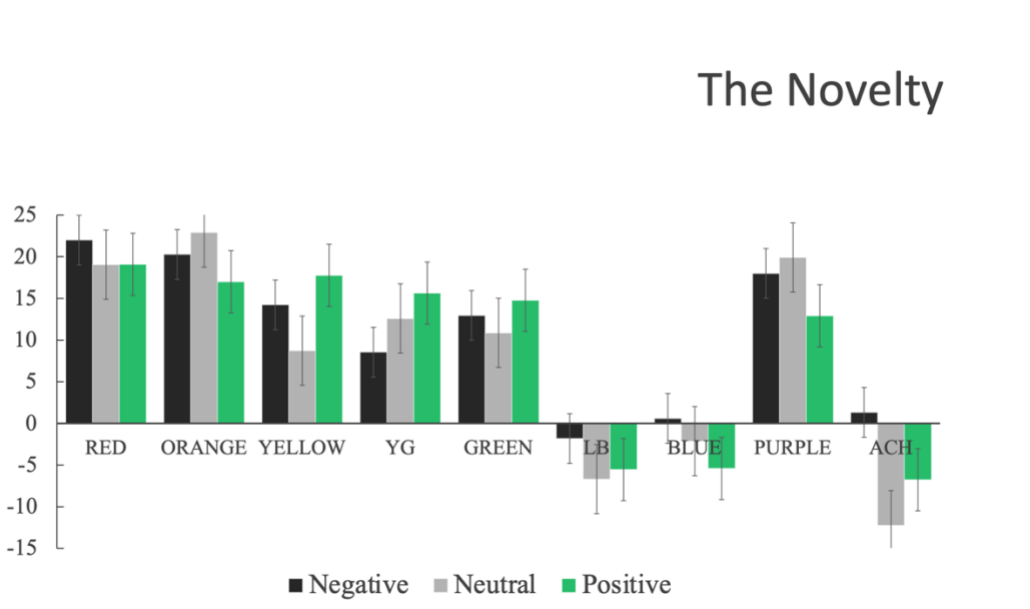


Fig. 26 | The perception of news novelty in the emotional contexts

Including achromatic color, there was no significant difference detected within the emotional contexts on each hue, whereas all significant differences appeared between the interaction of hue and context.

Regarding the primary hue, except for the blue, OCT with the rest hues made news in the various contexts perceived novel. The intermediate hue, except for the BG color, all the other hues made news in the various contexts perceived novel. It is worth noting that the news scenes with purple OCT were not inferior to other intermediate colors at all, and even better than some primary hues such as yellow and green.

The significant differences were mostly observed between the hues of red, orange, yellow, YG, green, purple and the hues of BG color, blue, achromatic color (Fig. 27 - Fig. 29). Specifically, in the negative context, the OCT with red made the news stronger than the BG color ($t = 4.82$, $p < .001$), blue ($t = 4.33$, $p = .006$), and achromatic color ($t = 4.19$, $p = .01$). In the neutral context, red was still significantly different from BG color ($t = 5.21$, $p < .001$), and blue ($t = 4.29$, $p = .007$) and achromatic color ($t = 6.33$, $p < .001$). This was also true in the positive context.

The orange color condition was similar to red, and it was stronger than BG color (negative, $t = 4.47$, $p = .003$; neutral, $t = 5.99$, $p < .001$; positive, $t = 4.56$, $p = .002$), blue (negative, $t = 3.98$, $p = .022$; neutral, $t = 5.07$, $p < .001$; positive, $t = 4.54$, $p = .002$) and achromatic color (negative, $t = 3.84$, $p = .038$; neutral, $t = 7.11$, $p < .001$; positive, $t = 4.81$, $p < .001$) in the three contexts.

The yellow condition did not have the same effects as red and orange. In the negative context, there was no difference between the above three colors. In the neutral context, it was only better than the achromatic color ($t = 4.24$, $p = .008$). In the positive context, it was stronger than BG color ($t = 4.72$, $p = .001$) blue ($t = 4.69$, $p = .001$) and achromatic color ($t = 4.97$, $p < .001$).

The YG color condition was stronger than BG color ($t = 3.90$, $p = .031$) and achromatic color ($t = 5.02$, $p < .001$). In the neutral context, it was similar to yellow. In the positive context, it was stronger than BG color ($t = 4.29$, $p = .007$), blue ($t = 4.26$, p

= .007) and achromatic color (t = 4.54, p =.002) respectively.

Green had significant differences in neutral and positive contexts. In the neutral context, it was stronger than the achromatic color (t = 4.67, p = .001). In the positive context, it was similar to yellow and YG color, and stronger than BG color (t = 4.11, p = .014), blue (t = 4.09, p = .015), and achromatic color (t = 4.36, p = .005) respectively.

BG color was weaker than purple in the corresponding context, i.e., negative (t = -4.01, p = .02) and neutral (t = -5.38, p <.001) contexts. By contrast, blue was only inferior to purple in the neutral context (t = -4.46, p = .003). As for purple, in addition to the above comparison pairs, in the neutral (t = 6.51, p <.001) and positive (t = 3.98, p = .022) contexts respectively, it was stronger than the achromatic color in the corresponding context.

In summary, concerning the news novelty, OCT with the yellow-green series can facilitate the novel expression in a positive context. Purple can make the news perceived as novel regardless of emotional contexts. Whereas, OCT colored by the blue series hues made the news perceived more generally.

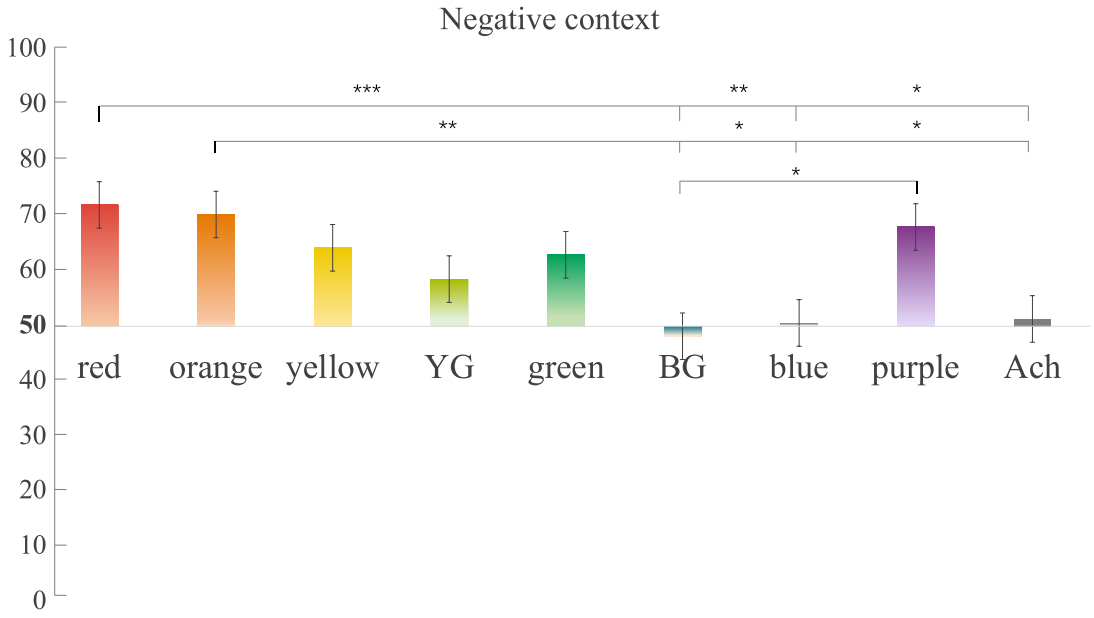


Fig. 27 | The significant differences on news novelty perception between hues in the negative context

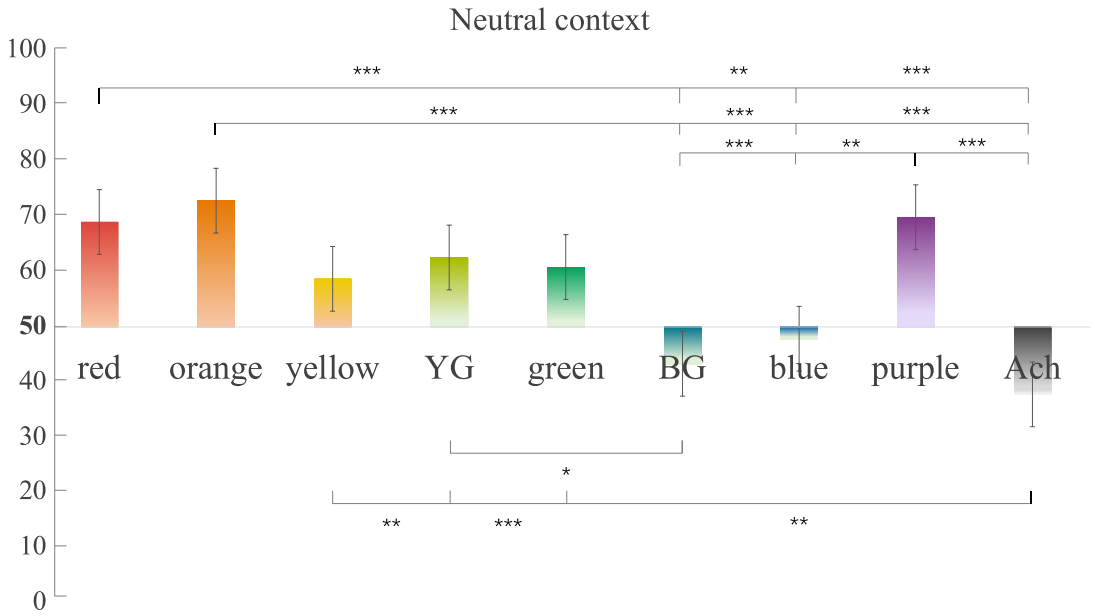


Fig. 28 | The significant differences on news novelty perception between hues in the neutral context

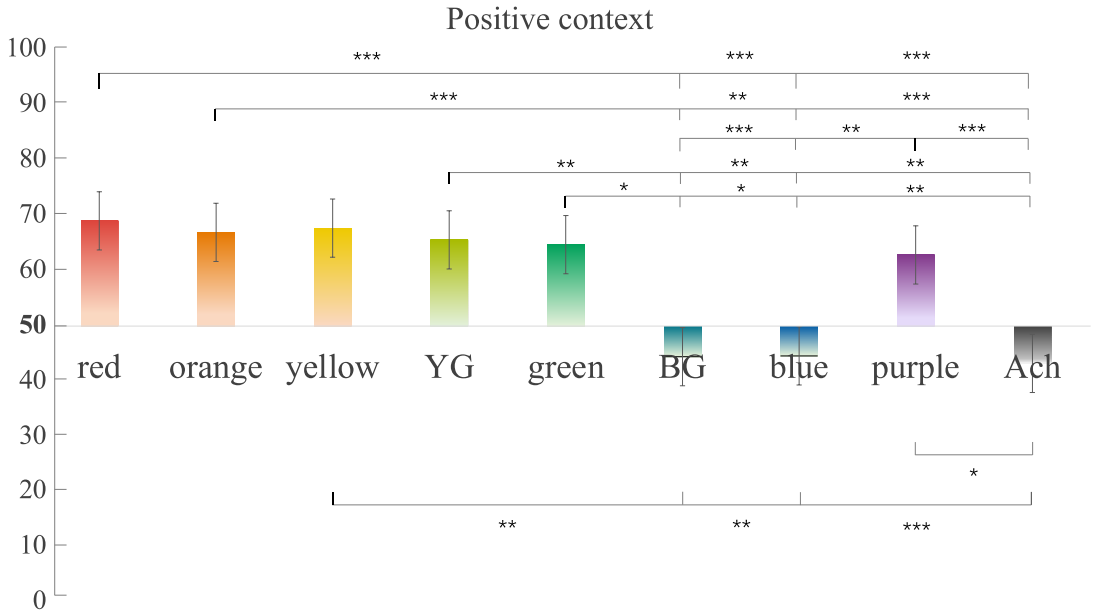


Fig. 29 | The significant differences on news novelty perception between hues in the positive context

Regarding the dimension of news timeliness, the OCT pattern colored by most hues can make the news scenes perceived timely than the control condition in various contexts (Fig. 30), but there were partial hues that may inhibit the perception of news timeliness. The contextual specificity of different hues was not the same. Regarding the interaction between the hue and emotional context, there was a significant difference observed between the conditions composed of these two factors (F [16, 336] = 4.53, p <.001).

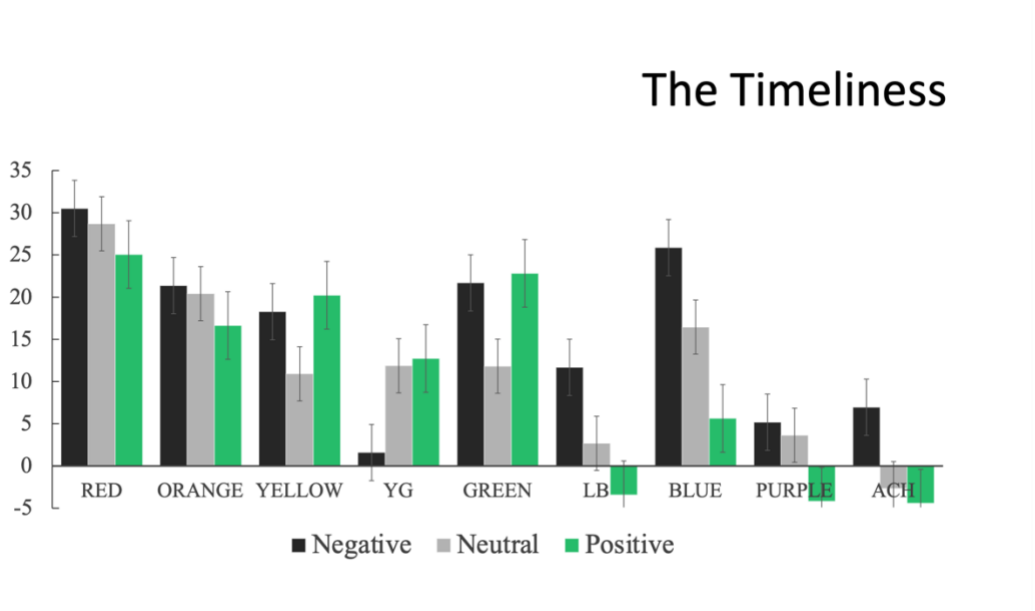


Fig. 30 | The perception of news timeliness in the emotional contexts

Specifically, except blue, there were no significant differences observed in the performance of the other hues within the emotional contexts, which reflects that the news timeliness on most hues is effective, although there was no significant difference between the contexts. Whereas, the significant differences were more commonly observed between hues themselves.

In the negative context, the timeliness of the news scenes with red OCT was significantly stronger than that of YG color (t = 5.61, p <.001), purple (t = 4.91, p <.001),

and achromatic color (t = 4.57, p = .002), shown in Fig. 31. The visual experience in the orange condition was stronger than that of the YG color (t = 3.84, p = .042). There was no significant difference between yellow and other hues in the same context, shown at a medium level. The YG color was significantly weaker than green as the primary hue (t = -3.90, p = .033). Similarly, blue as the primary color was perceived timely than the purple condition (t = 4.01, p = .021). As observed, with exception of orange, the other three intermediate hues made news perceived more recent, but the effect was limited. While, the OCT with primary hue in the negative context was observed a higher overall evaluation, revealing the association between primary color and news timeliness. This was roughly consistent with the results of the former experiment.

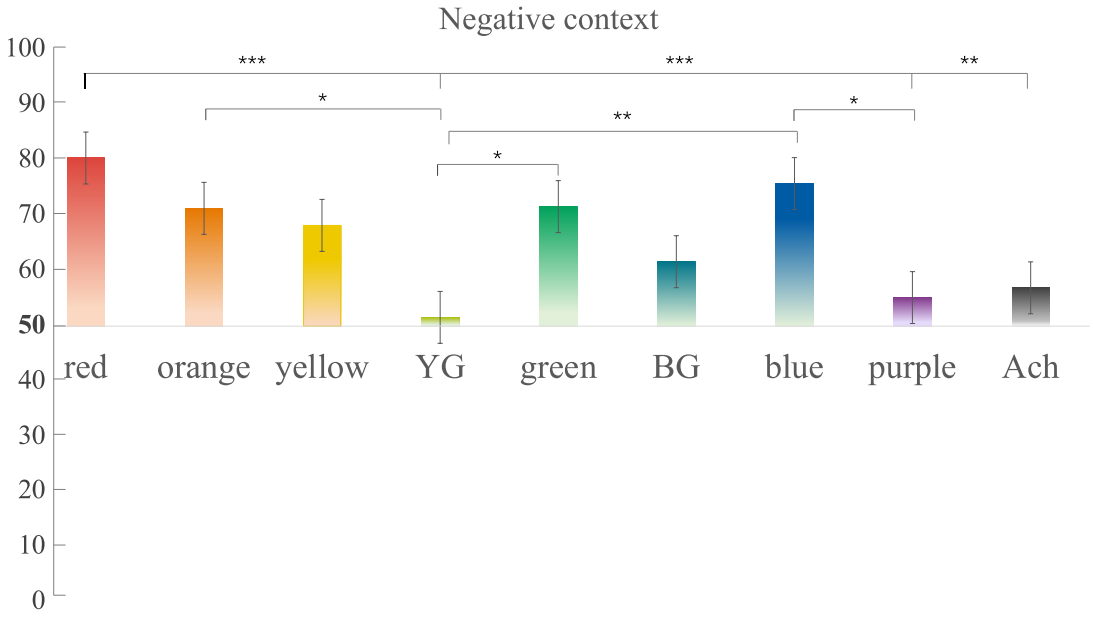


Fig. 31 | The significant differences on news timeliness perception between hues in the negative context

In the neutral context, the red scene was stronger than the BG (t = 5.05, p <.001), purple (t = 4.86, p <.001), and achromatic (t = 6.09, p <.001) conditions, shown in Fig. 32. Orange color was better than the achromatic color OCT scene (t = 4.48, p = .003).

There was still no significant difference between yellow and other hues. The yellow, YG colors and green were almost at the same level. The BG color and purple were roughly at the same level. The achromatic color blended with the background color in the neutral scene to cause poor visibility, and the evaluation shows negative. The blue was stronger than the yellow-green series and close to the red-orange series, which suggests that news scenes with red or blue OCT can be perceived more recently than the yellow-green condition in the neutral context.

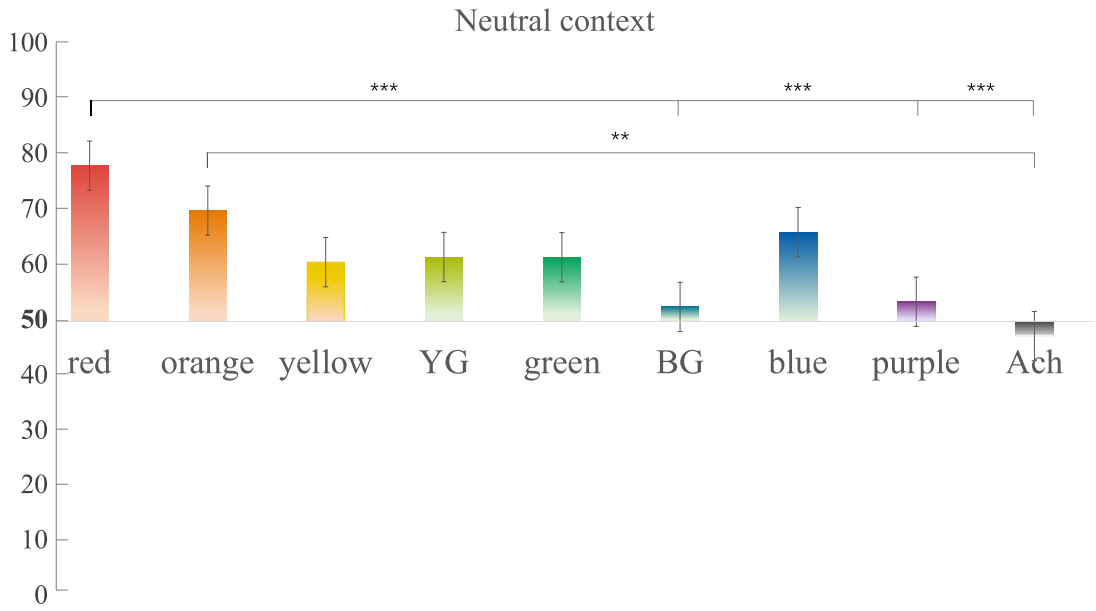


Fig. 32 | The significant differences on timeliness perception between hues in the neutral context

In the positive context, although the mean value of the red condition was not as high as the evaluation in the negative and neutral contexts (Fig. 33), it was still better than the intermediate hues of BG (t = 5.52, p <.001), purple (t = 5.67, p <.001) and achromatic color (t = 5.72, p <.001). It should be noted that the evaluations of these three colors were all negative, which implies that these colors may inhibit the news timeliness of positive news.

Orange color was almost similar to the red, since it was better than BG color (t = 3.89, p = .035), purple (t = 4.04, p = .019) and achromatic color (t = 4.08, p = .016). Different from the neutral context, it was obviously observed that yellow and green were suitable for the expression of news timeliness, i.e., they had the same effect as the red-orange hues, and there were significant differences appeared in BG color (yellow, t = 4.59, p = .002; green, t = 4.65, p = .002), purple (yellow, t = 4.74, p = .001; green, t = 5.24, p <.001) and achromatic color (yellow, t = 4.78, p <.001; green, t = 5.28, p <.001) respectively. This shows that the yellow-green series can make the news perceived more recent or temporal fresh.

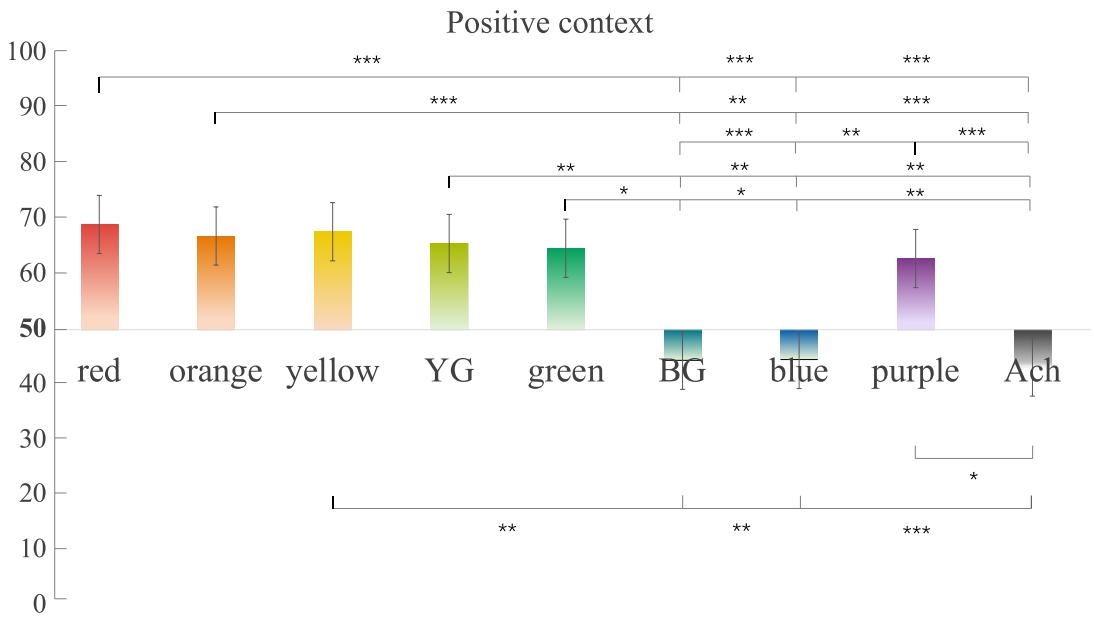


Fig. 33 | The significant differences on timeliness perception between hues in the positive context

In summary, the combination of primary hue OCT with the negative news contexts can make news content perceived more time-sensitive. The partial primary hues such as red and blue, as well as partial intermediate hue conditions such as orange OCT which is combined with neutral contexts also can make news scenes perceived more

newness or freshness. Except for blue-purple hues, most chromatic hues can make news perceived visual fresh in the positive contexts.

3.3.2 | The news value integration by OCT hue in the emotional contexts

The issue that whether the news values of different dimensions can be integrated by a single hue within the same emotional context would be analyzed through the correlation tests. By calculating the Pearson correlation coefficient of the news values, except for purple, the most hues can integrate the two dimensions of news values to a certain extent. Interestingly, a negative correlation was observed in the condition of purple, which was not observed in other conditions.

As shown in Fig. 34, the red OCT condition highly integrated the news value dimensions of the timeliness and importance in the negative context ($r = .766$, $p < .001$), and the dimensions of the novelty and timeliness in the positive context ($r = .685$, $p < .001$), and the dimensions of the timeliness and importance in the neutral context ($r = .515$, $p = .014$).

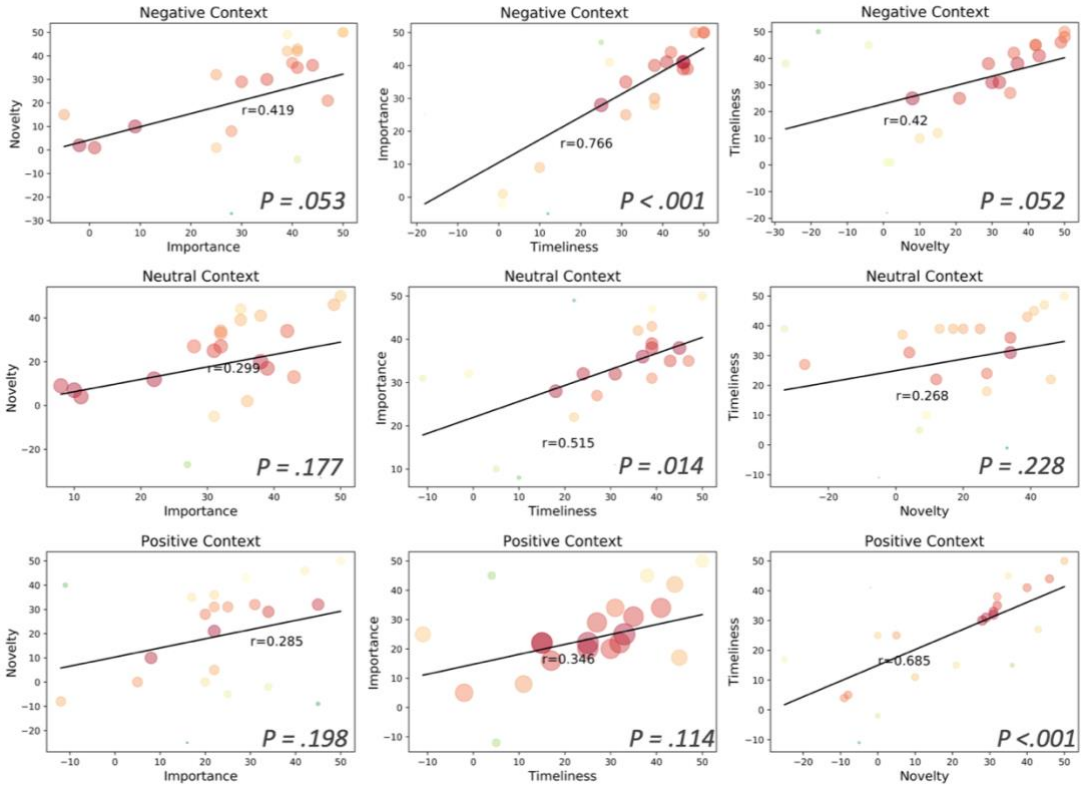


Fig. 34 | The situation of news value integration by red in the negative (upper row), neutral (middle row), and positive (lower row) emotional contexts.

As shown in Fig. 35, the orange OCT condition can integrate the news value dimensions of the timeliness and importance in all of the contexts (negative, r = .732, p <.001; neutral, r = 7.45, p <.001; positive, r = .801, p <.001), and the dimensions of the timeliness and novelty in the neutral context (r = .852, p <.001).

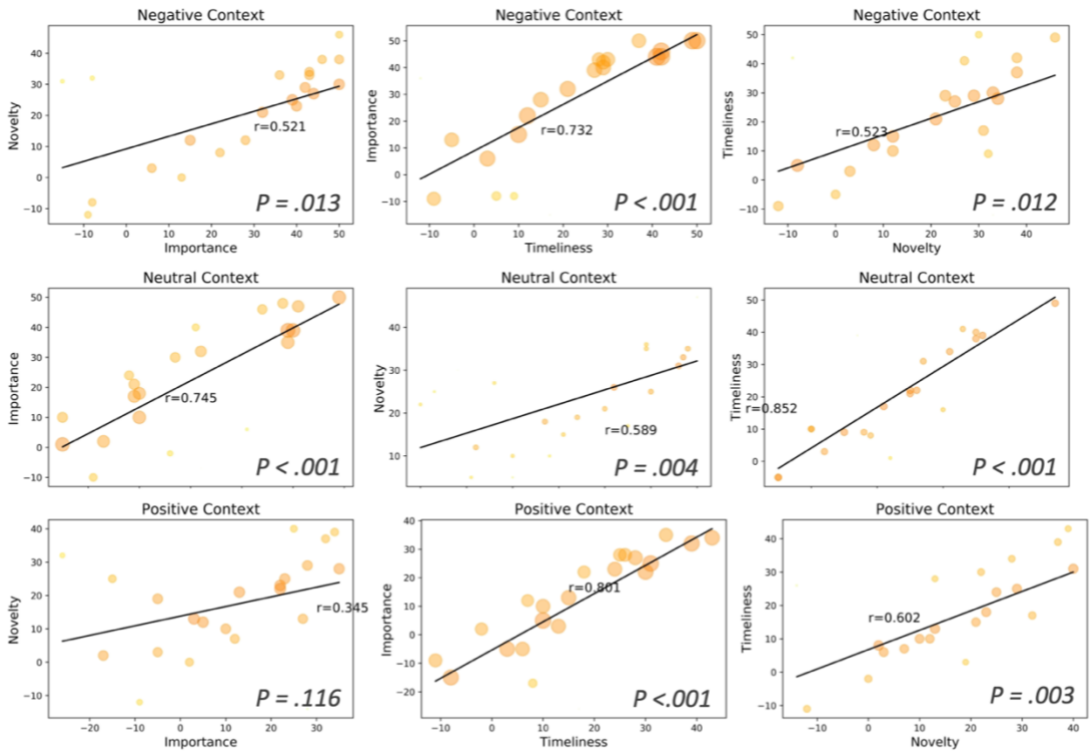


Fig. 35 | The situation of news value integration by orange color in the negative (upper row), neutral (middle row), and positive (lower row) emotional contexts.

Regarding the yellow OCT condition, as shown in Fig. 36, with exception of the negative context, the dimensions of the importance and novelty were integrated in the neutral context and the positive context respectively (neutral, r = .625, p = .002; positive, r = .646, p = .001), and the correlation of the dimensions of the novelty and timeliness was significant (neutral, r = .569, p = .006; positive, r = .717, p <.001). In all of the contexts, the yellow hue can integrate the importance and timeliness (negative, r = .730, p <.001; neutral, r = .754, p <.001; positive, r = .573, p = .005).

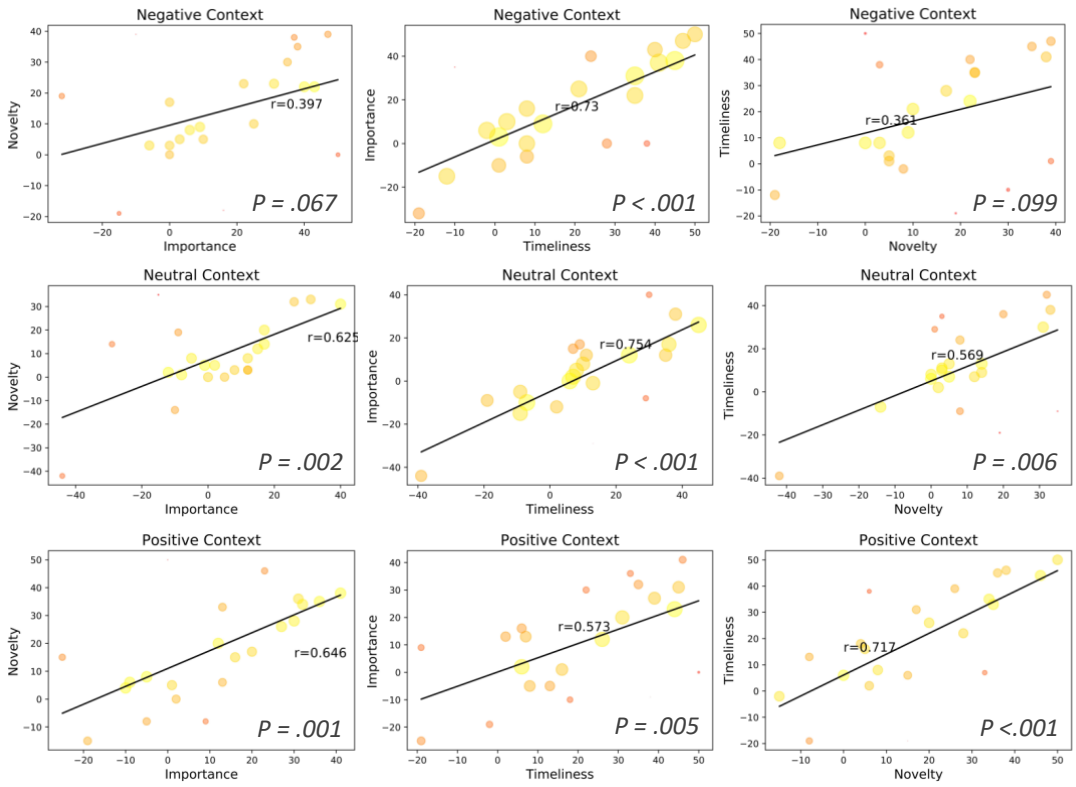


Fig. 36 | The situation of news value integration by yellow in the negative (upper row), neutral (middle row), and positive (lower row) emotional contexts.

In the YG OCT condition, the dimensions of the importance and timeliness were integrated significantly in the negative context (r = .752, p <.001), and the dimensions of the importance and novelty were integrated significantly in the neutral context (r = .718, p <.001), and the dimensions of importance and timeliness were integrated significantly in the positive context (r = .789, p <.001).

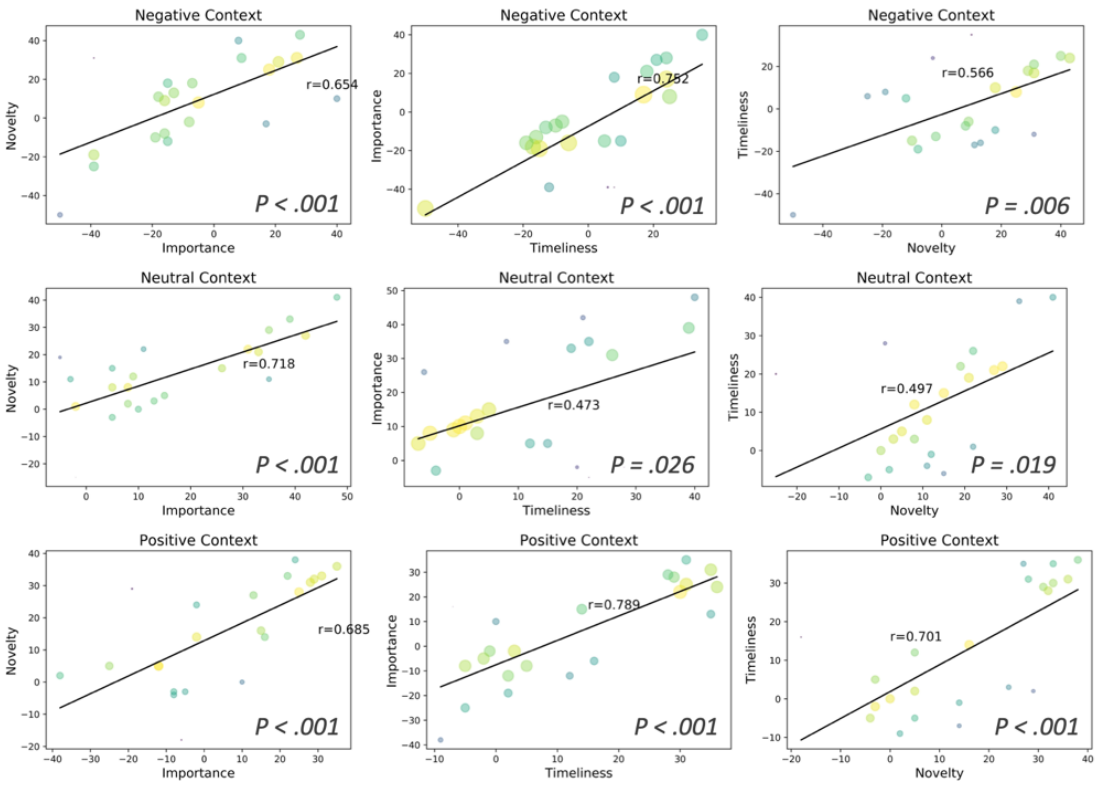


Fig. 37 | The situation of news value integration by YG color in the negative (upper row), neutral (middle row), and positive (lower row) emotional contexts.

Regarding the green OCT condition, as shown in Fig. 38, in the negative context, the perception of the news importance and timeliness was more consistent, whereas the news novelty appeared no significant difference in the correlation between the two dimensions. In the neutral context, significant differences were observed in the correlation coefficients of the novelty and importance (r = .511, p = .015), the novelty and timeliness (r = .796, p <.001). In the positive context, the news importance was strongly associated with the dimensions of the novelty (r = .51, p = .015) and the timeliness (r = .777, p <.001) respectively.

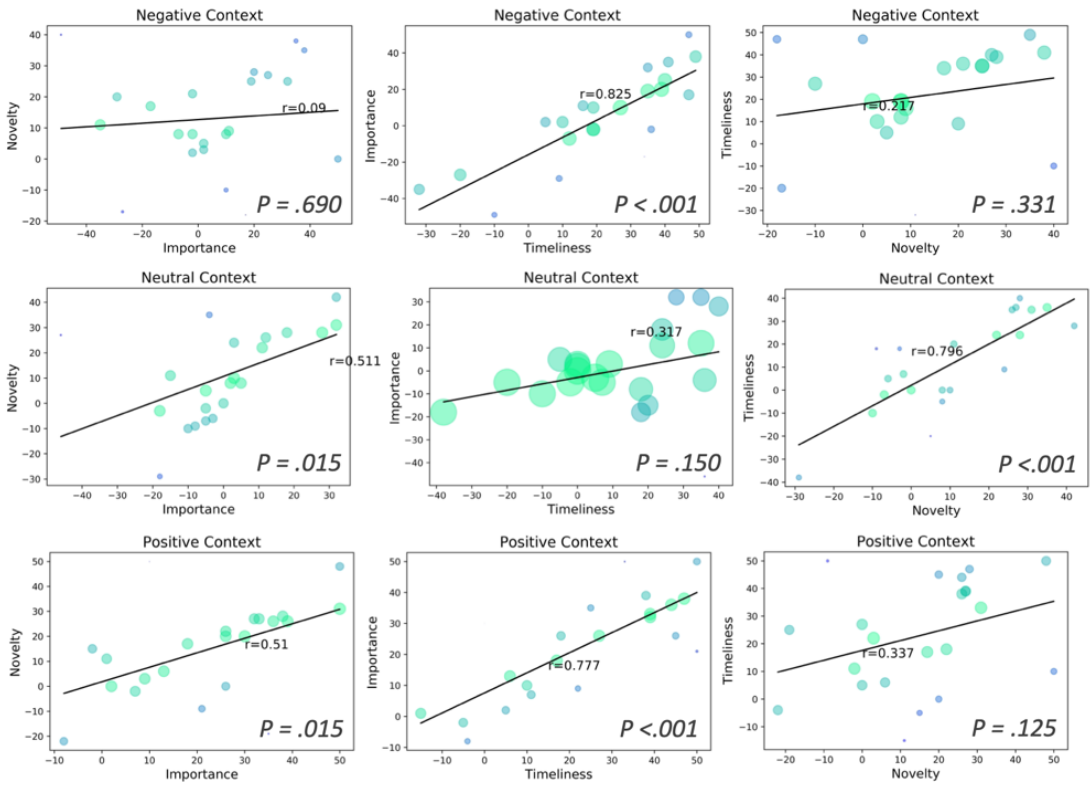


Fig. 38 | The situation of news value integration by green in the negative (upper row), neutral (middle row), and positive (lower row) emotional contexts.

The BG color OCT condition was similar to the YG condition (Fig. 39). It is worth noting that some correlation coefficient was as high as 0.9 or more in the negative context, which suggests that the BG color integrated the importance and timeliness at a higher level (r = .948, p <.001). The importance and novelty also had this trend observed in the neutral context (r = .921, p <.001).

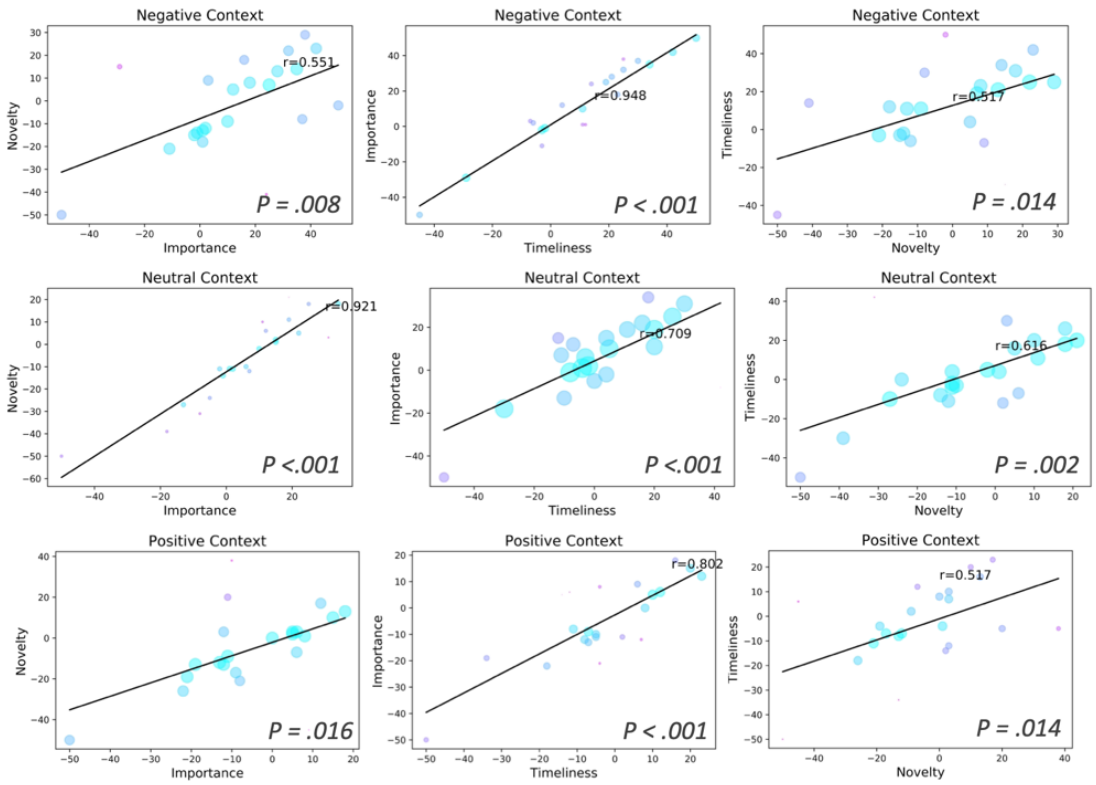


Fig. 39 | The situation of news value integration by BG color in the negative (upper row), neutral (middle row), and positive (lower row) emotional contexts.

As shown in Fig. 40, considering the blue OCT condition, because the discrimination between these two chromatic hues was very little, the results observed were similar to the BG color. Especially in the negative and neutral contexts, the dimensions of news importance and news timeliness were highly correlated (r = .911, p <.001). Whereas the novelty and importance were highly integrated into the positive context (r = .872, p <.001).

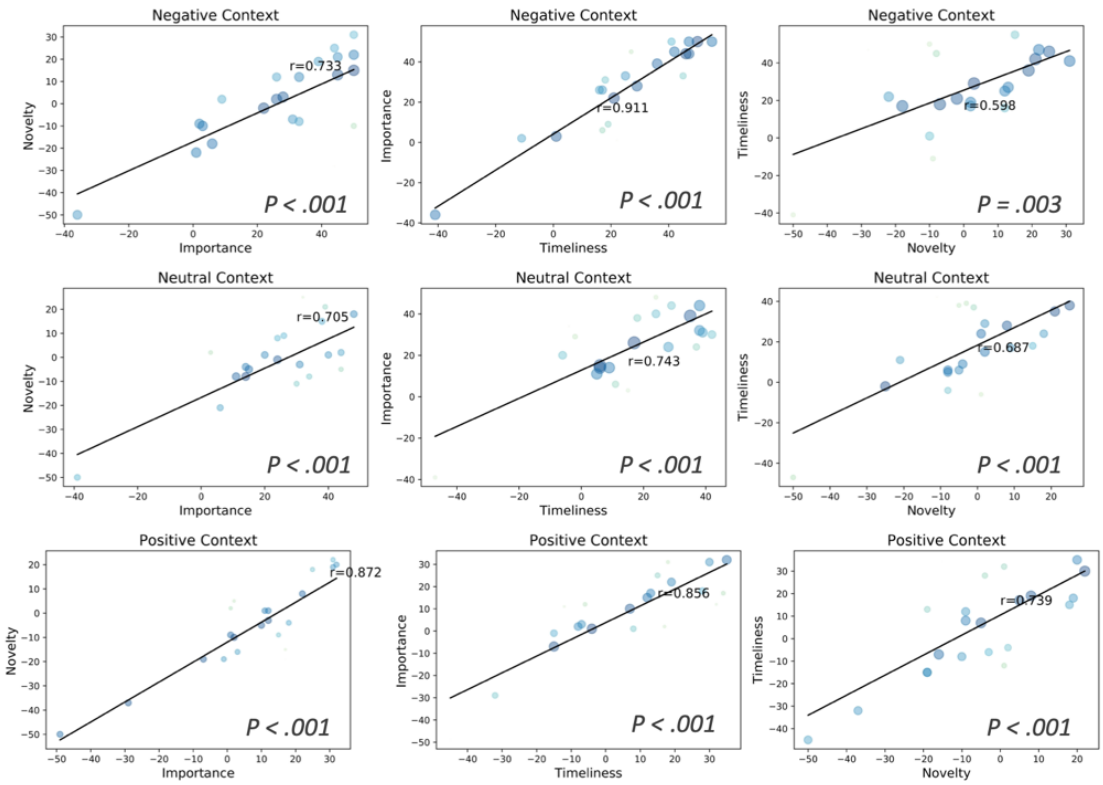


Fig. 40 | The situation of news value integration by blue in the negative (upper row), neutral (middle row), and positive (lower row) emotional contexts.

The purple OCT condition was the most unique among all chromatic hues. As shown in Fig. 41, in the negative context, a negative correlation was observed between the dimensions of importance and novelty (r = -0.155, p = .49). Besides, a zero correlation was observed between the dimensions of importance and timeliness (r = .055, p = .81). In addition to the significant correlation between timeliness and importance of the neutral context (r = .617, p = .002), other conditions were similar to those of negative contexts. This suggests that purple is not suitable for integrating the dimensions of news importance and news novelty, as well as the importance and timeliness in the negative scenes. The novelty was incompatible with importance (r = .054, p = .811) and timeliness (r = .06, p = .791) in the neutral scenes, which reveals that purple has a stronger novelty orientation.

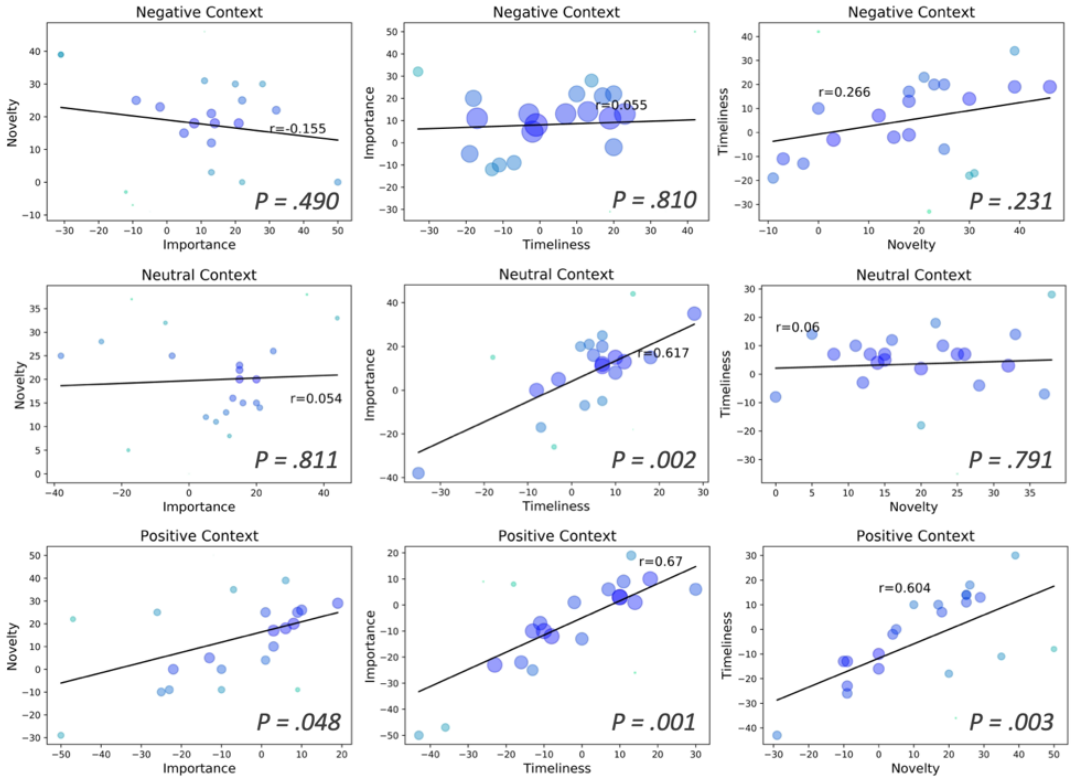


Fig. 41 | The situation of news value integration by purple in the negative (upper row), neutral (middle row), and positive (lower row) emotional contexts.

Regarding the achromatic OCT condition, as shown in Fig. 42, the dimension of news importance significantly associated with the news timeliness was observed in various contexts. Since the above analysis of variance made it clear that achromatic hue is difficult to indicate the novelty, there was no significant correlation between importance and novelty in various contexts. While only significant differences can be observed in the correlation coefficients between novelty and timeliness in the positive context. According to the data distribution, more than 50% of color points were concentrated in the area of zero or even below, which indicates that the situation was opposite to the chromatic hue, i.e., in the positive context, the achromatic color interfered with the expression of the news novelty and timeliness.

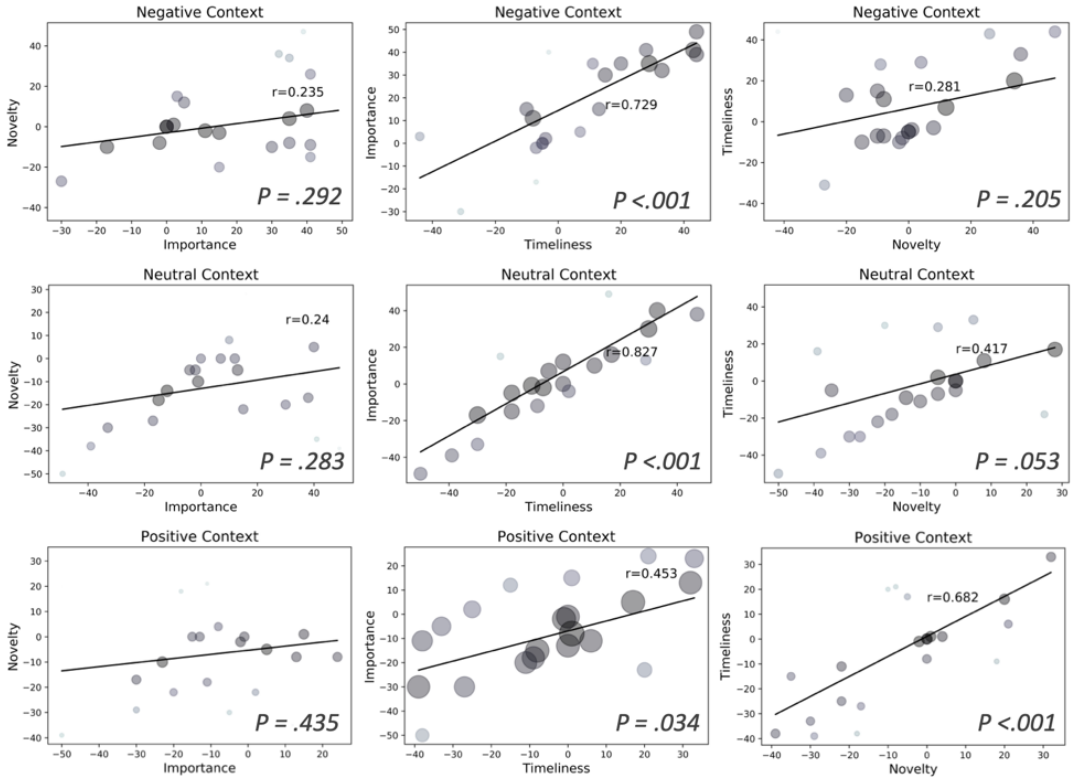


Fig. 42 | The situation of news value integration by the achromatic hue in the negative (upper row), neutral (middle row), and positive (lower row) emotional contexts.

3.4 | Discussion

In this section, the issue that whether the OCT hue can affect the news value perception in the actual news contexts was explored. According to the results, the news scenes with different color OCT were consciously noticed by the participants; thus, a large number of significant differences were observed between the color conditions. In other words, the perception of the news values in the actual news scenes was significantly influenced by the OCT hue manipulation. Benjamin H. Detenber revealed that people feel, or consciously believe they feel, that color pictures are more pleasing and exciting than monochrome versions of the same image.[4][6] The results of this

section are basically in line with this insight. In the *Color-in-context* theory, the first principle asserts that color carries meaning, and the sixth principle asserts that color meanings and effects are context-specific.[3] This is generally agreed by this research.

In the red OCT condition, the evaluation of each news scene was high and there was no significant difference between the news scenes. Only a slight difference was observed in the mean value of each dimension, i.e., the negative context was higher than the positive context. Moller AC et al. pointed that red was positively associated with failure and general negative words, and was negatively associated with success and general positive words, whereas green was positively associated with success words only.[40] In their research, the reaction time that is used to judge the correspondence between red and negative words was significantly faster than that of green and white. A psychophysical study suggests that significant differences have been observed between brain waveforms of the P1 component generated by three image stimuli (positive, central, negative) in the parieto-occipital area (*PO3, O1, Oz, O2, PO4*) by ERP. Specifically, the pairwise comparison revealed that P1 elicited by negative cues significantly differed from P1 elicited by neutral (p = 0.004) and positive cues (p = 0.021), but P1to positive cues did not differ from P1 to neutral ones (p = 0.14).[28] This result aims to clarify that red can attract attention to negative emotional contexts better than neutral and positive emotional contexts. Similarly, although there was no significant difference between the news scenes in this section, the performance of red OCT in the negative context was consistent with their insights.

In the yellow OCT condition, although there was no significant difference between the news scenes, the mean value of each dimension reflects the characteristics of the hue itself. In the dimensions of the importance and timeliness, the negative scene was slightly stronger than the positive scene; in the dimension of novelty, the positive scene was slightly stronger than the negative scene. A study discussed the effects of screen color on the perception of the time required to load a web page.[19] The results of its first experiment show that the yellow condition take longer than the blue condition, i.e., participants in the blue-hue condition perceived the download as quicker than did participants in the yellow-hue condition. By comparing the data of the yellow and blue

conditions in this section, this conclusion can support the news scenes in the negative and neutral contexts, whereas the opposite is true in the positive context, the yellow condition was better than that of blue.

In the condition of green OCT, there were significant differences between news scenes in the importance dimension, and no significant differences were found in other news value dimensions. It is worth noting that, in the perception of the news novelty and timeliness, the mean value of the positive scene was slightly higher than that of the negative scene, which suggests that green was more inclined to express positive emotions. A study explored the contribution of green effectiveness in sports scenes.[2] It highlighted that the positive effects of green exercise on physical and psychological wellbeing have been found. It also clarified that as a primitive feature of visual sensation green has a contributory effect toward positive exercise outcomes. By contrast, other studies argued that there was no evidence to assure the significant association between green and positive image, but it still can be regarded as a reference. Besides, a study involved the association between the ambient green and creativity.[30] Although its results did not show that green has a significant impact on creativity, it implies the possibility of such an effect. In terms of value orientation, to some extent, these results indicated the positive significance of green. Especially in this section, concerning the importance of the news scene, the effects of green and red in the positive context were very similar and even far exceeding other hues.

Concerning the blue OCT condition, the importance dimension was consistent with the results of the former experiment, especially in the negative and neutral contexts, the positive color consciousness of blue was emphasized. Wang T et al. examined the effects of red and blue on Chinese emotions through the perspective of social psychology.[71] Their results show that red induced positive and negative emotion, while blue only induced positive emotion. And highlighted that the influences of color on emotion were rooted in both natural and social associations. For Chinese, the associations of blue to positive emotion, and red to negative emotion, were natural associations. However, the associations of red to positive emotion were social associations. Thus, the positiveness of blue was emphasized in this section, which

indicates that blue can make the news perceived important that can be regarded as positive effects similar to the positive emotion in the mentioned association. Also, the dimension of novelty was consistent with the results of the former experiment (see Chapter 2), i.e., the blue shows pale and weak in the news novelty perception and even inhibited the expression of news novelty. This was mainly due to the low visual arousal of the blue color series; thus, it can be regarded as a relatively stable hue. The dimensions of the news timeliness and importance were highly coupled, because its correlation coefficient was as high as .911 in the negative context and .856 in the positive context, which can also support the results.

Most studies rarely involved intermediate hues, and there were almost no intermediate hue researches in the news field. In this research, paying attention to the intermediate hues was concentrated. Concerning the orange OCT condition, in terms of the novelty evaluation, it was even greater than other hues overall, and the result was very similar to red. Eva Heller revealed that in Confucianism, the religion and philosophy of ancient China, orange is the color of transformation. Yellow is the color of perfection and nobility; red is the color of happiness and power. Yellow and red are compared to light and fire, spirituality and sensuality, seemingly opposite but complementary. Out of the interaction between the two came orange, the color of transformation.[14] It can be seen that orange is a transformation of red and yellow, and it has the characteristics of both. Therefore, the long-wave intermediate hues like orange are of great significance for optimizing the news value and should be taken into consideration in news practice.

Regarding the condition of YG color OCT, the perception of the news importance depends to a large extent on the context. Specifically, YG color inhibits the original news importance in the negative context, but the opposite is true in the positive context, which was more similar to green since they all belong to the same color series. Combined with the fact that the evaluation was better in the neutral context, it implies that YG color was more inclined to perform the news importance in the context without obvious emotional directivity. The evaluation of the news novelty and timeliness tends to be achieved in a positive context. However, the overall cognitive evaluation of YG

color was not sufficient; thus, it needs to be handled according to specific circumstances in actual use.[32]

In the condition of BG color OCT, the overall perception of the news importance was lower than that of the blue. Although some participants reported that the visual discrimination between the two was close, there was still a significant difference between the two from the experiment, which indicates the differences between the intermediate hue and the primary hue. In the news novelty perception, because of the obvious differences in arousal between the short-wavelength hues such as blue or BG color and the warm long-wavelength hues (see Chapter 2), they are visually more restrained. Regarding the news timeliness perception, the performance of the BG color in the negative context was better than other intermediate hues except for orange color, whereas other emotional contexts were not suitable with this.

In the purple OCT condition, it was more inclined to indicate the news novelty than the dimensions of the news importance and timeliness. Eva Heller described that in Europe and America, purple is the color most associated with vanity, extravagance, and individualism. To some extent, it explains the lower utility of purple. She also pointed out that purple is the color most often associated with the artificial and the unconventional because it is the major color that occurs the least frequently in nature and is the first color to be synthesized. And the fact is that purple has been used by the nobles in history, which results that the purple consciousness of the overall society being blurred compared to other hues. Also, as mentioned in the former chapter, purple is the color most associated with ambiguity.[14] Thus, the inherent characteristics, i.e., the novelty of purple can be grasped from the perspective of its historical origin.

CHAPTER 4

| The effects of OCT tone on perception of news value in the emotional context

4.1 | Introduction

As another important attribute of color, i.e., tone, is it similar to hue that can also influence the perception of news value? This issue was discussed in this chapter. In our lives, words are used to describe tones such as bright, gray, and vivid, etc., which reflects that tone tends to be more of an expression for the color senses. Concerning the concept of tone, it is in a blended state, i.e., tone consists of lightness and chroma of the color attributes. Lightness is the brightness of the color, whereas chroma is the vividness of the color. Except for research, the sensory representation of color is usually expressed in everyday life in terms of tone rather than the concepts of lightness and chroma. In other words, in this section, the perception of the value of a news scene will be clarified by processing the tone of the OCT pattern. Due to the variety of tones, the selection at this stage is based on basic bright and deep tones not involving bizarre tones that are applicable to art fields, which is in line with the basic logic that news is the reporting of facts. In this section, the exploration of the meaning of tone manipulation in the given emotional context will be continued. Based on the above considerations, the research questions were proposed in following.

RQ1: In the negative context, can the OCT colored by the bright tone or deep tone make news scene perceived more important? In the neutral context, are there significant differences between the bright tone and deep tone OCT manipulation when judging the news importance? In the positive context, can the bright tone or deep tone inhibit the expression of news importance?

RQ2: In the negative context, can OCT colored by the bright tone or deep tone make news considered more novel? In the neutral context, which tone could indicate the news novelty? In the positive context, can the bright tone or deep tone OCT make the news perceived novel?

RQ3: Under which tone do the three news scenes have significant differences when perceiving the news timeliness? E.g., does the bright tone OCT have different meanings for the news timeliness in the positive scenes and negative scenes? Does the deep tone

OCT have different meanings for the news timeliness in the positive scenes and negative scenes?

4.2 | Method

4.2.1 | Stimuli

An actual example of the stimulus image is shown in Fig. 43, where the image is divided into three parts, the upper part was the stimulus body (A), the middle part was the corresponding image number and *control* text (B), and the lower part was the scale (C). Within the part A, the OCT pattern was colored by bright tone (left) and deep tone (right), compared with the vivid tone (center) as the control tone condition. The area ratio of OCT in the present news scenes is about 20.52%, which is the result of the calculation based on the above design size. As a reference, this ratio is about 24.55% in the upper right of Fig. 1 and about 15.16% in the lower right of Fig. 1, which depends on the specific application scenario, and there is not yet a uniform specification about this ratio. Part B is the numbering of the randomly arranged stimulus images. Part C is the evaluation scale, where 50 was circled by a white-background box for emphasis.

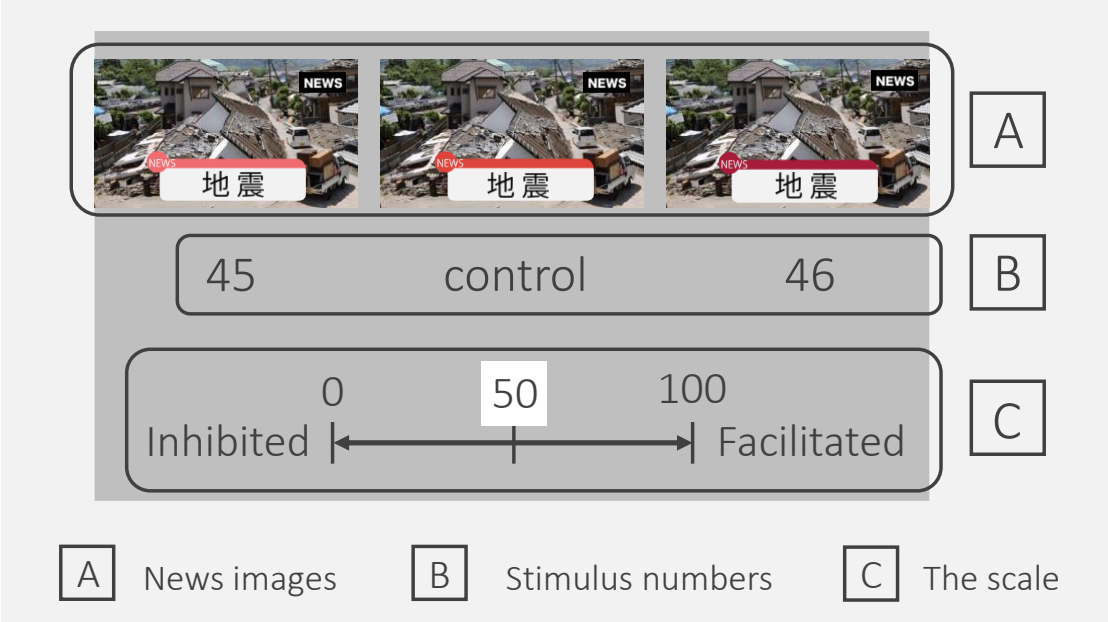


Fig. 43 | An actual stimulus example of tone manipulation by red hue on the earthquake scene. Within the figure, from the left to the right of this stimulus (A), the colored OCT is observed as bright tone (the number of 45), vivid tone (the text of control), and deep tone (the number of 46).

4.2.2 | Participants

Thirty-two students and staff, including but not limited to Hokkaido University, were recruited, including twenty-two Chinese and ten Japanese. There were twenty males and twelve females (20–55 years, M = 28.69, SD = 8.39). Of all participants, twenty people indicated that they had never participated in similar experiments before, including one affiliated with Hokkaido University; twelve people indicated that they had participated in psychological experiments before, including four people that they had participated in experiments similar to the current experiment more than twice, and the remaining eight people indicated that they had hardly participated in experiments similar to the current experiment before, all affiliated with Hokkaido University.

Of all participants, twenty people indicated that they participated in this experiment by wearing colorless and clear myopic glasses, and seventeen of them indicated that

they wore myopic glasses on a daily basis. The remaining three participants had clear, colorless myopic glasses but did not wear them on a daily basis, and they only wore them when reading or watching video. All participants who wore glasses were asked to make sure that the lenses are clear and non-tinted during the experiment. Wearing other eyewear other than for vision correction, including but not limited to sunglasses, etc., was not acceptable in this experiment. Regarding color vision, all participants indicated that they had previously been given and passed the Ishihara test. Thus, all had normal or corrected-to-normal visual acuity and color vision. The participants were provided with informed consent at the beginning of the experiment.

4.2.3 | Apparatus and Experimental Environment

The experimental period was during the epidemic stage of the COVID-19. To ensure the safety and health of the participants, the experiment was conducted online. Thus, the experimental equipment was prepared by the participants themselves. During the experiment, all participants provided the appropriate equipment as required. The requirements of the experimental equipment and operating environment were: this experiment requires the use of 9.7-inch iPad (Participants using iPads with screen sizes larger than 9.7 inches were required to inform the experimenter in advance), but the use of smartphones and iPads with screen sizes smaller than 9.7 inches to participate in the experiment will not be recognized. The iPad requested for use in this experiment is based on the 6th generation (officially announced to be manufactured in 2018), which has the following technical specifications: with a 9.7-inch retina level display, 2048 × 1536 resolution, 264ppi. Make sure that the iPad used can be displayed normally and properly. The screen should be adjusted on non-night view mode, and the brightness manually set to 50% for the experiment duration. If there are any uncertain display problems, please inform the experimenter in advance, and make sure that the iPad system does not see any abnormalities. The experiment needed to be completed independently and quietly, so the iPad needed to be on silent mode.

The above requirements can reduce the differences generated by the parameter settings of different monitor brands, different color rendering methods of monitors, and differences in the usage status of monitors in terms of age to a certain extent. Therefore, the using of a uniform size iPad was adopted. Although there may be other better ways to avoid possible problems due to monitor color differences35, this is the method used in this experiment so far. We will also continue to explore methods that are more suitable for online experiments.

4.2.4 | Procedure

The experiment was divided into a preparation stage and a conduction stage. Regarding the preparation stage, participants confirmed and complied with the following requirements. It included that stay in a relatively quiet indoor environment, and the room equipped with a 60W white fluorescent lamp illuminated from the ceiling. Prepare a piece of A4-sized paper and a pen in advance. Prepare a fully charged 9.7-inch iPad (see more detail in Apparatus), and download the experiment PDF file (the Japanese and Chinese versions available) via the Internet to run on the iPad (adjust to the single page display mode). Set the iPad to landscape mode, and place the iPad on a horizontal table. Sit upright in front of the iPad, and maintain the eyesight perpendicularly to the iPad screen, and keep eyes at a distance of 40 cm (measured by a straightedge) from the iPad front. During the experiment, little breaks was permitted.

When the above operation is ready, the conduction stage begins. This experiment itself was conducted via PDF file. Within the PDF file, based on the Japanese and Chinese translations, as shown in Fig. 44, two major parts were included, i.e., the instructional pages and the stimulus images pages. The instruction pages consisted of a description page, a caution page, a news images page, an evaluation scale page, a control images page, an answer sheet, an answer format page, and a consent form page. Then, the actual trials pages followed.

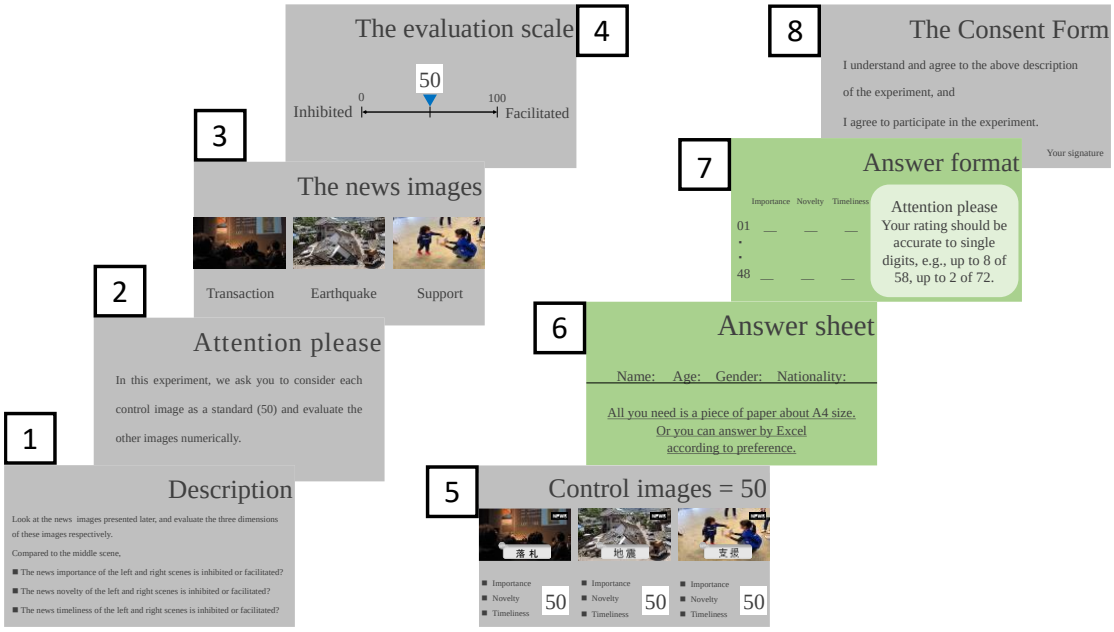


Fig. 44 | The procedures of instruction consisted of the description page, the caution page, the news images page, the evaluation scale page, the control images page, the answer sheet, the answer format page, and the consent form page.

The description page described what needs to be done for the experiment. Specifically, look at the news images presented later, and evaluate the three dimensions of these images respectively. Compared to the middle scene, the news importance of the left and right scenes is inhibited or facilitated? The news novelty of the left and right scenes is inhibited or facilitated? The news timeliness of the left and right scenes is inhibited or facilitated?

The caution page highlighted the significance of the reference value, i.e., 50. The news images page, from left to right, presented the news scenes used in this experiment, i.e., transaction, earthquake, and support.

The evaluation scale page, the evaluation scale used in this experiment was a 101-point scale (0–50–100), which appeared in the center of the screen. A blue inverted triangle on the scale pointed to the middle of the scale, which is 50, indicating the value of the news scene with the OCT colored by the vivid tone corresponding with a

chromatic hue. The interval of 0–50 indicated that the corresponding news value of the news scene was lower than the control condition, i.e., 50, while the range of 50–100 indicated that the corresponding news value of the news scene was facilitated. Thereafter, the control images page presented, in which three news scenes with the image of OCT by gray color appeared. Below each news scene, the three news value dimensions were presented, and to the right side of the dimension texts was the reference value, i.e., 50 written in black on a white background.

The answer sheet and answer format page (an Excel format file was also attached), with a light green background, required participants to fill in personal information (answer with pen and paper) and record their answers (note: your answer should be accurate to single digits), respectively. Finally, there was the consent form page, where participants were required to sign a consent form for the entry. Above, all the steps in the experimental instruction were introduced.

Regarding the order of the trials, each of the three news value dimensions was evaluated independently, i.e., first, all trials of the news importance dimension were conducted; then, all trials of the news novelty dimension were conducted; finally, all trials of the news timeliness dimension were conducted. As shown in Fig. 45, the trials order within each news value dimension was a random arrangement, i.e., one of the three news images appeared randomly each time, as well as the OCT pattern was randomly colored by one of the eight chromatic hues at a time. The onset of each trial was with a fixation i.e., +. Then, the recommended duration between the fixation and stimulus (see Fig. 43) was 10s, since the PDF file does not seem to account for the duration parameter, after which the responses began.

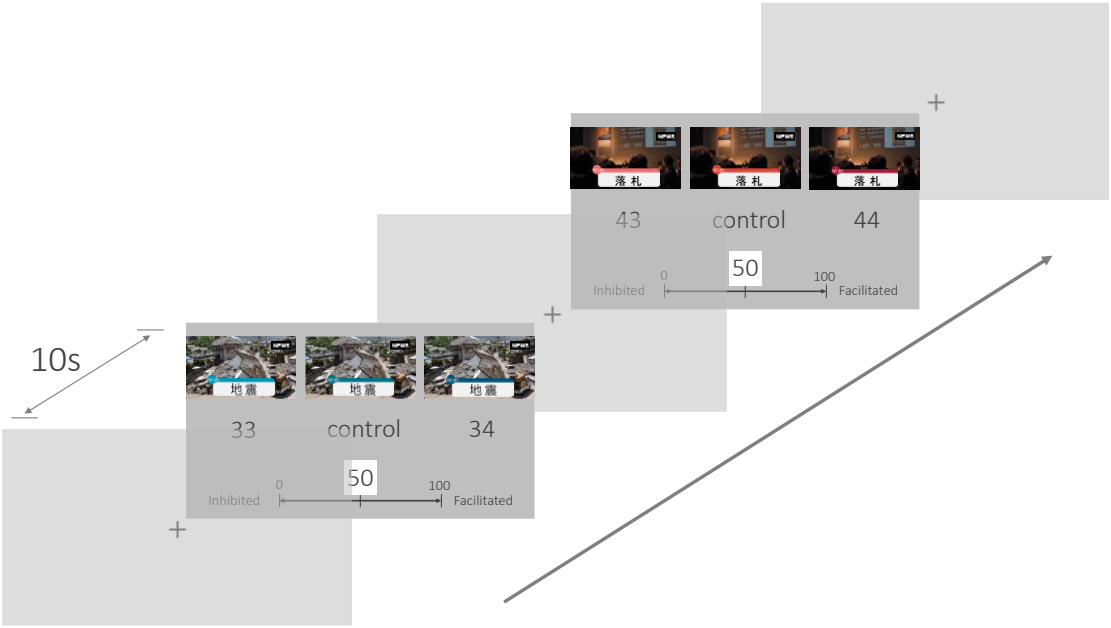


Fig. 45 | The order of the trials within each news value dimension was a random arrangement.

Except for the control image (center), each target image (left and right) to be evaluated was set with a unique number, i.e., the image number. In this way, the number of targets to be evaluated for each news value dimension was: 2 tones × 8 hues × 3 news = 48 trials. The total number of targets to be evaluated for the three news value dimensions was: 48 trials × 3 dimensions = 144 trials. Counting the time for reading the experimental instructions, the whole experiment took roughly 30 minutes.

4.3 | Results

4.3.1 | The effects of color in the perception of news value

Based on the design (2 tones × 8 hues × 3 contexts), a repeated measures ANOVA was conducted. According to the results, concerning the parameter of tone, the perception of the importance of news scenes changed, and there was a significant difference between the bright (Br) and deep (Dp) tones (F [1, 434] =16.31, p <.001). Significant differences were observed in the interaction between tone and emotional context (the news images) (F [2, 434] = 7.39, p <.001), which suggests that regardless of the kind of OCT hue, both factors act on the perception of news importance simultaneously. Furthermore, the interaction between tone and hue shows significant differences (F [7, 434] = 5.76, p <.001), which indicates the effect of certain colors and the relatively weaker context dependence. However, there was no interaction between tone, hue, and context, which reflects that the processing effect between the conditions composed of these parameters was similar and implies that other factors may affect the visual perception of news value, i.e., the multimode of the visual content such as sound or other non-visual factors.

Regarding the main effect of the tone (Fig. 46), there was a significant difference between the bright condition and the deep condition, and the importance of the news scene in the deep condition was stronger than that of the bright condition (t = -4.04, p <.001), which suggests that news with deep tone OCT was perceived as more important than news with bright tone OCT.

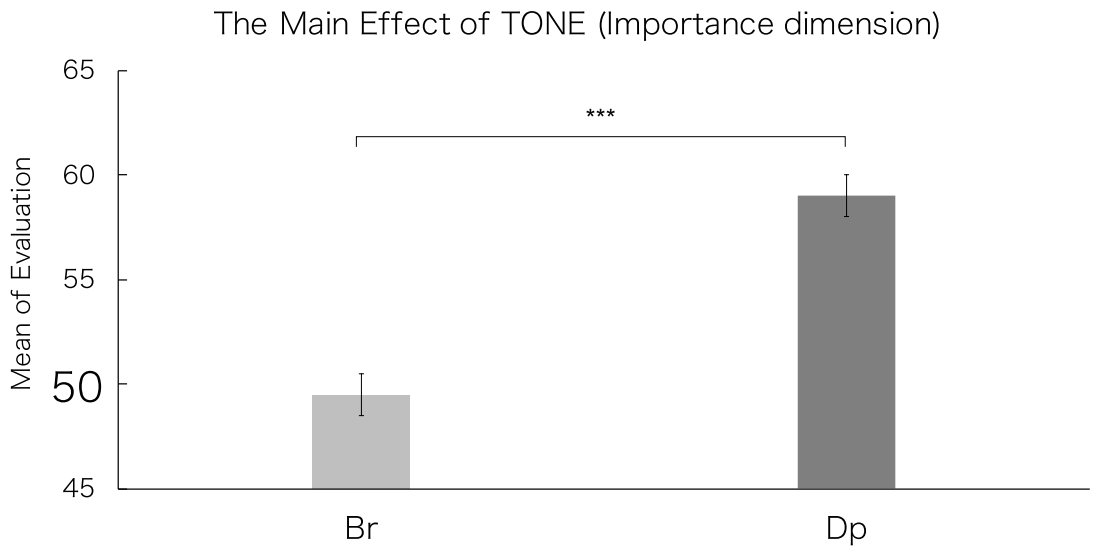


Fig. 46 | The main effect of tone on the perception of the importance dimension

Concerning the interaction between tone and context, as mentioned in the main effect of tone, the performance of the bright tone was lower than that of the deep tone in all contexts. As shown in Fig. 47, the significant difference can be observed in the neutral context and the negative context, i.e., the OCT with deep tone makes the news perceived more important than that of the OCT by bright tone in the neutral context (t = -3.79, p = .004). Similarly, the OCT with deep tone makes news perceived more important in the negative context than that of the OCT with bright tone (t = -4.98, p <.001). In condition of positive context, the perception of news importance was not significantly different in the processing of the two tones. Thus, the deep tone was more inclined toward the perception of the importance of negative news, which reveals that the effects of tone are context-specific.

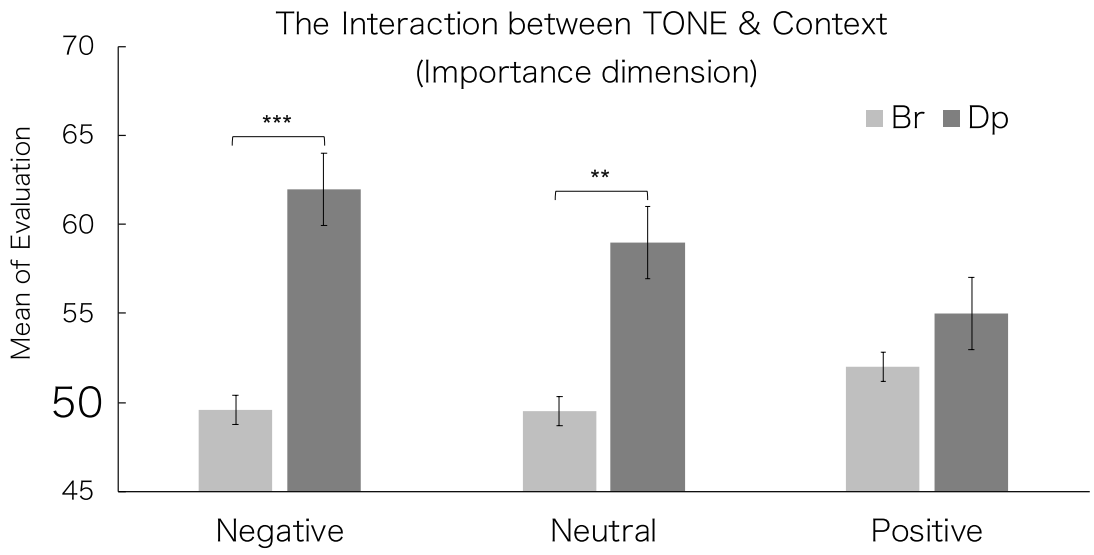


Fig. 47 | The interaction between tone and emotional context on the perception of the importance dimension.

As shown in Fig. 48, the overall interaction between tone and hue was consistent with the above; the performance of deep tone was stronger than bright tone, and significant differences were observed in the hue of red (t = -5.14, p <.001), green (t = -4.10, p = .009), and purple (t = -5.26, p <.001). Although there were differences in other hues, they were not significant, and the differences in warm colors were smaller than those in cool colors. It is worth noting that the difference between the two orange tones was the smallest, and the mean value of bright orange was higher than other hues within the same tone. The hue of purple by deep tone was stronger than other intermediate colors in terms of the indication of news importance.

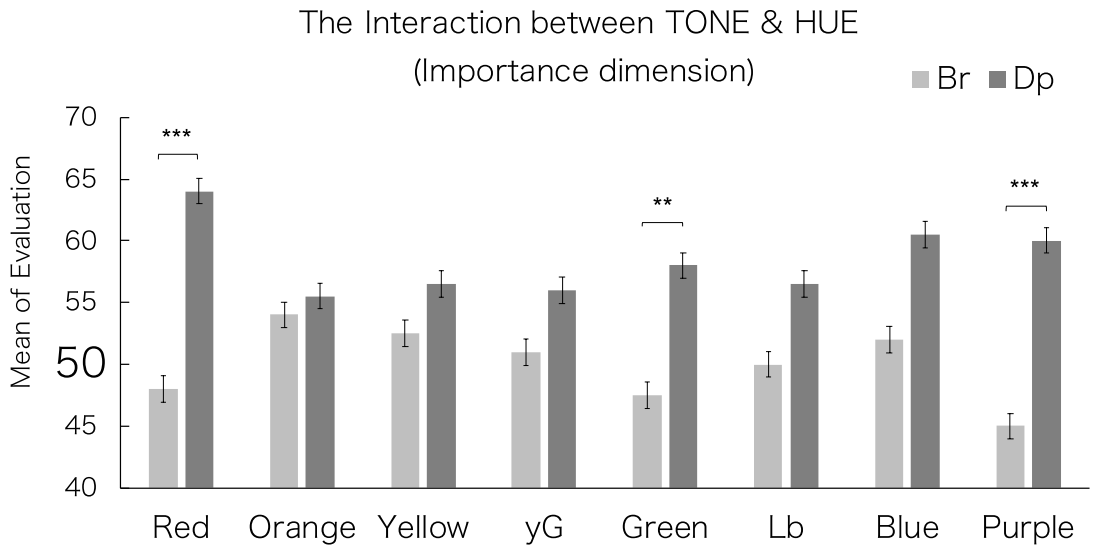


Fig. 48 | The interaction between tone and hue on the perception of the importance dimension.

Concerning the perception of news novelty, the main effect of tone factor shows significant differences (F [1, 434] = 45.20, p <.001), and the interaction was also significantly different between the factors of tone and hue (F [7, 434] = 8.08, p <.001), which suggests that the color of OCT does have certain influences on the visual freshness of news content, but needs to correspond with specific news context.

However, there was no significant difference between the factors of tone and context on the interaction, which was unexpected and suggests that regardless of the kind of news, the effect of the tone of OCT may be the same. However, the tone by itself had a strong novelty indicating effect. There was no significant difference in the interaction between tone, hue and, context. In addition to the above-mentioned third-party parameters that may exist other than color vision, there were hints at the limitations of color in visual news. As believed by other researchers, color plays an auxiliary rather than a fundamental role in the process of this kind of news dissemination, i.e., the importance and novelty of news and the timeliness of transmission themselves may affect news perception with the color factors simultaneously.

As shown in Fig. 49, the significant difference between the main effects of tone factor was mainly reflected in the novel feeling of the bright tone, which presented visual freshness generally better than the deep tone ($t = 6.73$, $p < .001$). It is worth noting that the tone performance was totally different from the importance dimension.

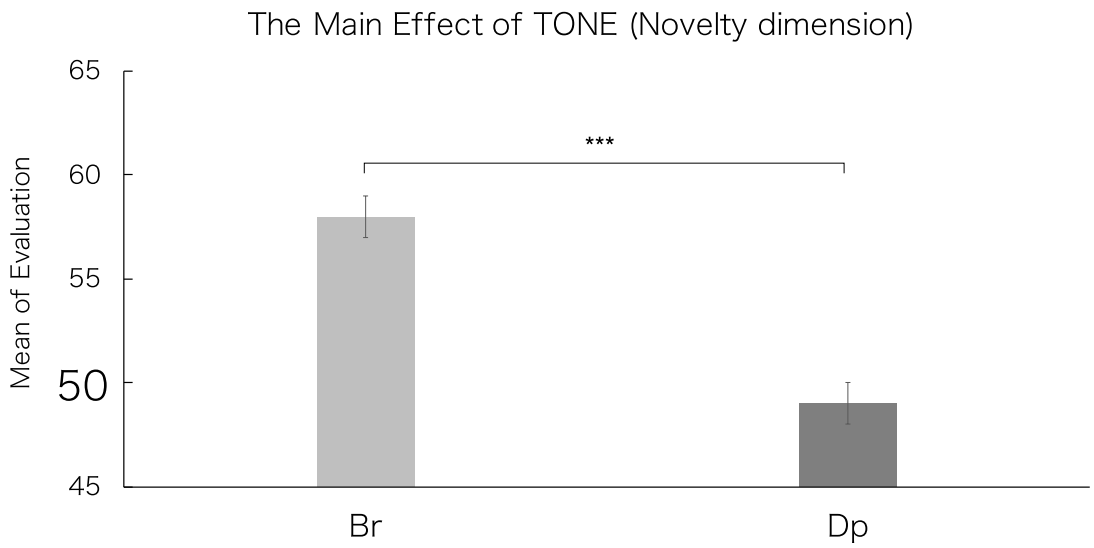


Fig. 49 | The main effect of tone on the perception of the novelty dimension.

In the interaction of news novelty perception between tone and hue, as shown in Fig. 50, the mean values of the two tones in red, green, and purple were very close. By contrast, the two tones combined with other hues show huge and significant differences in the OCT news scenes. Specifically, the orange in the bright tone far exceeded the deep tone ($t = 6.43$, $p < .001$). The yellow in the bright tone also performed better than that of the deep tone ($t = 6.77$, $p < .001$). The yG color by the bright tone was better than that of the deep tone ($t = 4.43$, $p = .002$), bright Lb color was better than the deep tone condition ($t = 5.17$, $p < .001$), and bright blue was significantly different from the deep blue ($t = 4.47$, $p = .001$). According to the feedback from participants, there was visual closeness between the test conditions, i.e., bright tone or deep tone and the control

condition, i.e., vivid tone in the red, green, and purple, which reflects the stability of these three chromatic hues.

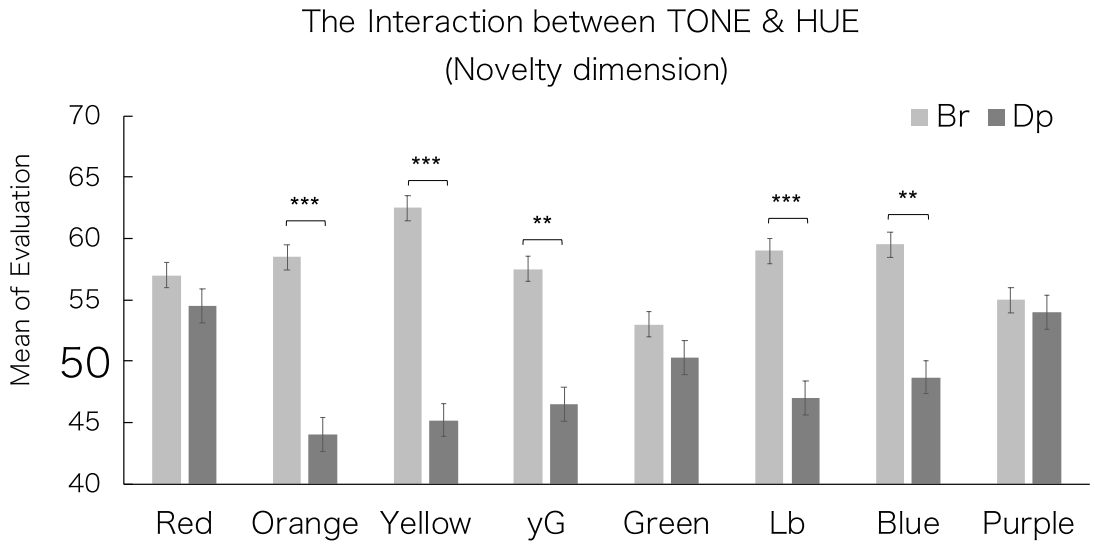


Fig. 50 | The interaction between tone and hue on the perception of the novelty dimension.

The visual perception of news timeliness is that what kinds of colors could enhance the temporal newness of news, or what kinds of colors would inhibit the recency expression of news. Based on this analysis, there was a large cognitive difference between the timeliness dimension and the other two news value dimensions. The fact that there was no significant difference in the main effect of the tone reflected. By calculating the mean value of the bright tone and deep tone, we found that both conditions were approximately equal to 54, and they both were higher than the control condition of 50. Therefore, both tones had the effect of facilitating news timeliness, and their effects were at the same level.

The interaction between the factors of tone and context was significant (F [2, 434] = 10.87, p <.001). When the OCT manipulated by bright tone, the news scene with a positive context seemed more time-sensitive than the negative context (t = -2.96, p

= .049) (Fig. 51), whereas in the deep tone condition, the news scene with a negative context were perceived as temporal fresh than in the positive context ($t = 4.81$, $p < .001$). This contradicted the above bright tone and indicates that the combination of tone factor and specific context can make news timeliness more targeted. The news timeliness of the neutral context also seemed stronger than that of the positive context within the deep tone condition ($t = 3.05$, $p = .04$). Thus, when the bright tone OCT adopted, news scenes with a positive context may be perceived as timely and fresher, whereas news scene with a negative context could present more time recency against the deep tone OCT.

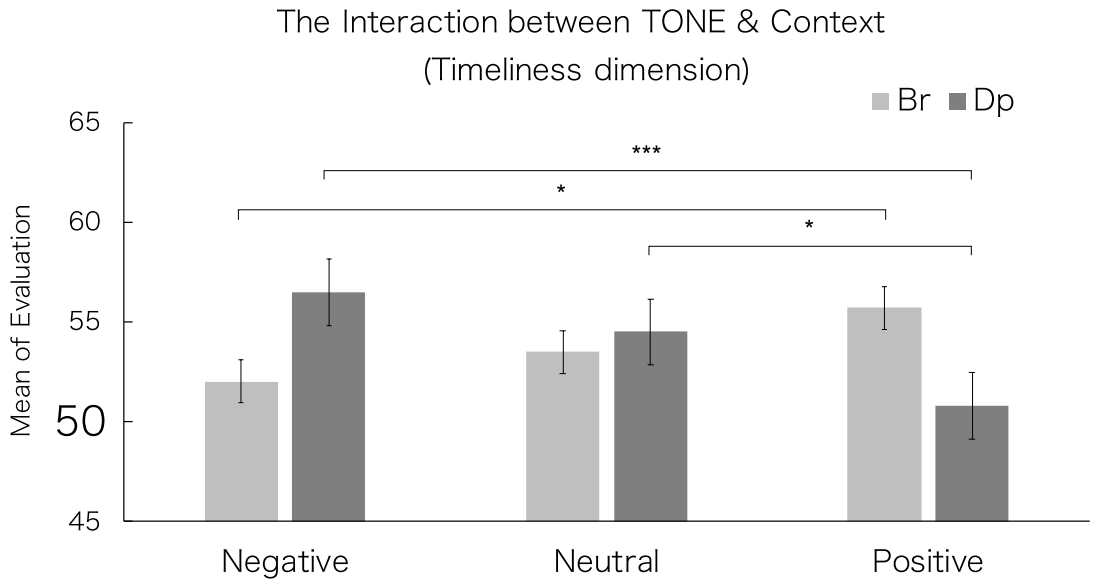


Fig. 51 | The interaction between tone and emotional context on the perception of the timeliness dimension.

The interaction between tone and hue mainly reflected the following tendency. The timeliness of news scenes in which the OCT was colored by deep tone red was higher evaluated than that of the bright tone, but there was no significant difference between

the two tones (Fig. 52). The news timeliness of deep-toned red was significantly stronger than that of yellow ($t = 3.63$, $p = .038$), yG ($t = 3.59$, $p = .044$) and Lb ($t = 5.17$, $p < 0.001$) colors within the same tone, while the bright-toned red was generally lower than these three hues within the same tone condition. The news timeliness performance of orange color in the bright tone was significantly better than that of purple within the same tone ($t = 3.54$, $p = .022$). This difference indicates that in addition to the primary hues, there was also a clear difference in the strength of the temporal indications between the intermediate hues in a specific tone.

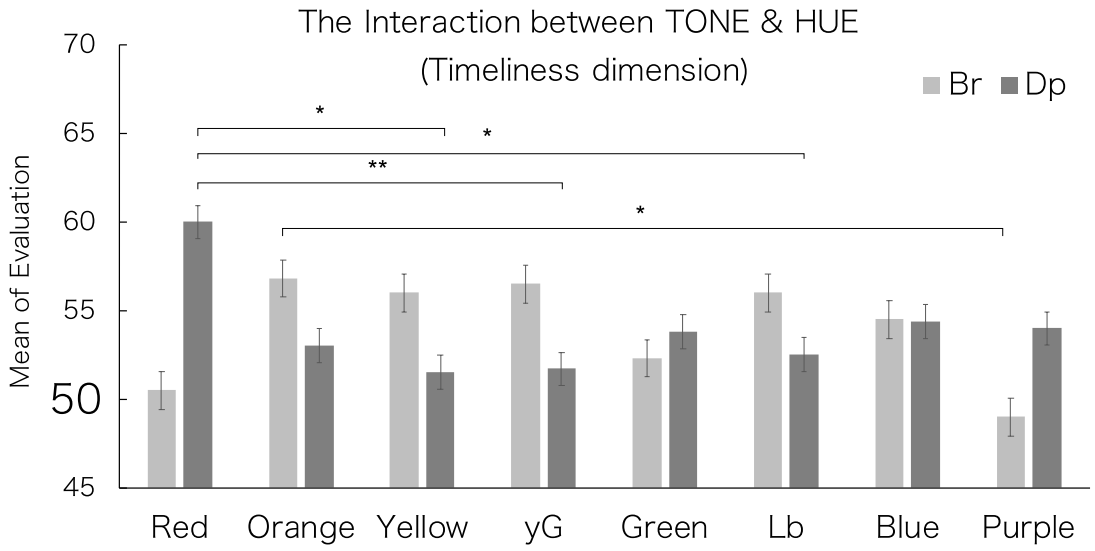


Fig. 52 | The interaction between tone and hue on the perception of the timeliness dimension.

4.3.2 | The news value integration by color in the emotional contexts

In journalism practice, whether one color can integrate the three news values simultaneously, as well as the integrated extent and trend, needs to be considered. According to the emotional contexts, 3D spaces that can present the three news values simultaneously were created. As shown in Fig. 53, the value perception of the different

news scenes after tonal processing deviated from that of the control condition, i.e., the star-shaped origin. This suggests that a close relationship between tone and emotional context affects the perception of news value to a certain extent.

Fig. 53-1 shows that in the negative context, the overall performance of bright tone and deep tone had a distribution from the upper right to lower left. Regardless of tone, the hues were mostly distributed independently in space. We also observed that the deep tone was spatially located on the right side of the bright tone, which reveals that the deep tone had a greater impact on importance indication.

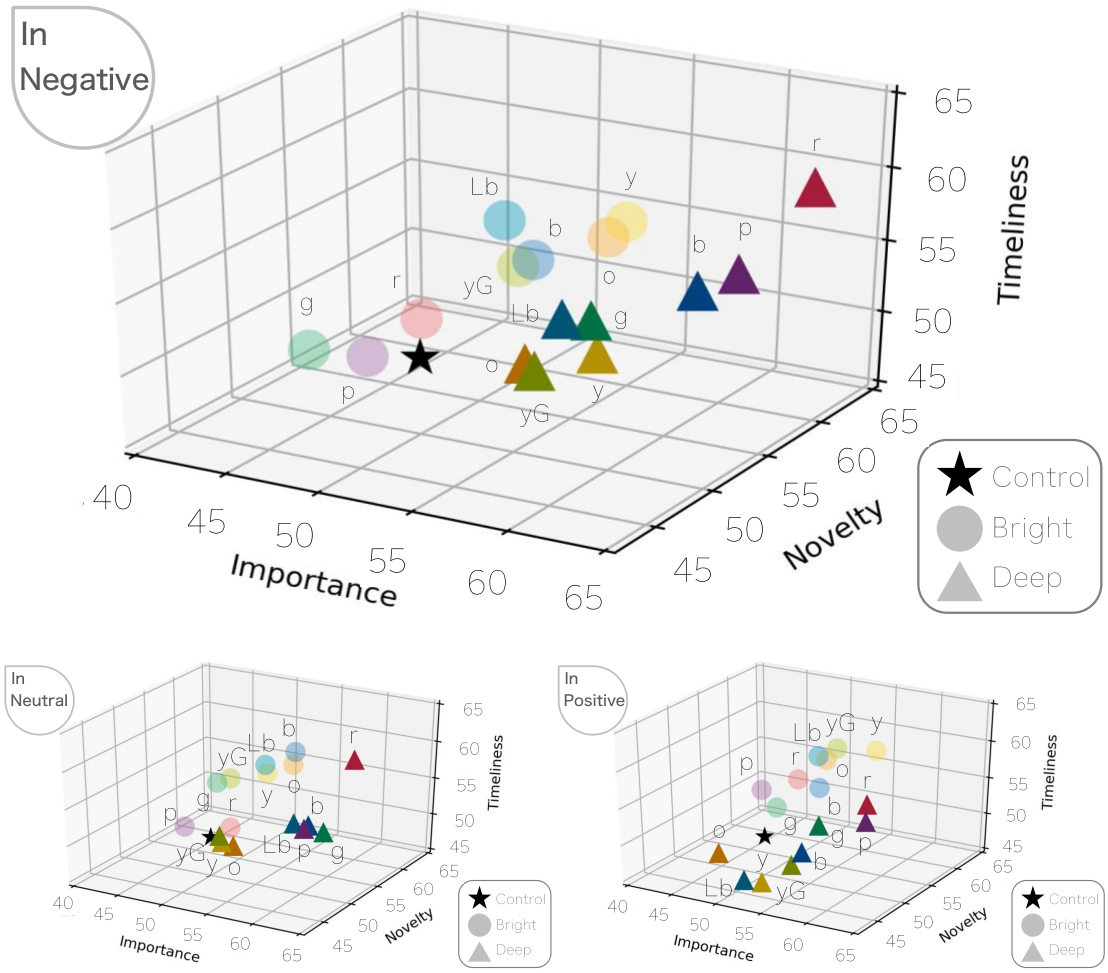


Fig. 53-1 | The integration of three news values in the negative emotional news context presented by the space. The spaces of neutral (left) and positive (right) were shown in the lower position as conferring information.

The red in deep tone was always in a more eye-catching position. In the negative context, the overall performance of red was the most prominent, and the integration of these three news value categories as importance (I), timeliness (T), and novelty (N) were significant respectively ($r_{[I, T]} = .713$, $p < .001$; $r_{[I, N]} = .513$, $p = .003$; $r_{[N, T]} = .444$, $p = .011$), although the correlation of the latter two was not as stronger as that of the former.

The location of deep-toned yellow was at the bottom of the space as a whole; thus, it was difficult to integrate the dimension of timeliness. By contrast, the bright-toned yellow achieved a better combination of importance and timeliness ($r_{[I, T]} = .711$, $p < .001$), as well as novelty and timeliness ($r_{[N, T]} = .607$, $p < .001$).

Green was weak enough to perform in the domain of timeliness, and the deep tone was no exception. It is worth noting that, in the negative context, there was a negative correlation between importance and timeliness ($r_{[I, T]} = -.069$, $p = .706$), although it was not significant. This suggests that green with the deep tone cannot integrate the two dimensions. Green with the bright tone was on the far left of the lower left side, and the integration of news values was very limited.

Regarding blue, the deep tone tended to be suitable in the negative context, while the bright tone blue tended to fit the neutral context. In the negative context, the deep tone blue was in the upper right direction, and its importance was second only to red condition, while novelty performance shows the negative effect, although the negative correlation between the two was not significant ($r_{[I, N]} = -0.55$, $p = .763$), which suggests that the news value was less integrated with the deep tone condition. The bright tone blue was the opposite, effectively integrating the two dimensions of novelty and timeliness ($r_{[N, T]} = .650$, $p < .001$).

In the negative context, the deep-toned orange was on the right side of the control, pointing in the important direction same as other deep-toned hues. The correlation between importance and timeliness shows significance ($r_{[I, T]} = .588$, $p < .001$), hinting at a time-sensitive tendency compared to other hues. In the bright tone condition,

novelty, and timeliness were significantly higher integrated ($r_{[N, T]} = .786$, $p < .001$). The yG color by deep tone, integrated the importance and timeliness dimensions ($r_{[I, T]} = .480$, $p = .005$), but it was inferior to the other hues based on its effectiveness. Its novelty performance had a negative effect and was biased toward the vertex, which highlights importance and time sensitivity but lacks novelty. The bright tone slightly improved the visual importance of news, and novelty and timeliness also tended to the backside, but there was no significant correlation ($r_{[N, T]} = .085$, $p = .644$); thus, the integration was not sufficiently clear.

The Lb color, the deep tone visually shows the same level of news timeliness as active as purple in the negative context, and the indication of news importance shows the same level effect as active as the yG color, with a tendency to the vertex that represents important and time-sensitive while lacking novelty, but no significant correlation was observed; thus, the degree of integration was not satisfactory. The bright-toned Lb color shows as higher as the yellow on the timeliness, and the novelty was close to orange, but the importance dimension shows a passive expression; thus, the integration of news value stays in the dimensions of news novelty and news timeliness ($r_{[N, T]} = .419$, $p = .017$).

Regarding purple, in the negative context, the deep tone tends to upper right vertex visually, and the importance was the same as other hues; thus, the news importance in deep tone has an effect, and the news timeliness was active, but no significant correlation was observed between them ($r_{[I, T]} = .253$, $p = .162$). At the same time, it was very different from the other deep-toned hues because of its positive effect on novelty perception, and it is worth noting that the mean value of novelty was close to red. The correlation between novelty and timeliness was significant ($r_{[N, T]} = .567$, $p < .001$). The purple by deep tone can effectively integrate the news value of the two dimensions. The purple by bright tone was around the control origin, which reveals that the effect is determined by tone manipulation.

As shown in Fig. 53-2, in the neutral context, the distribution of both tones shows a stacked situation, which suggests that the effect of manipulation within this kind of

tone or hue was relatively closer. The overall distribution visually tended to be more up and down. In particular, except for red, the other deep-toned hues were below the bright tone accordingly, which indicates that the timeliness of news scenes colored by bright-toned OCT was better than those colored by deep-toned OCT in the neutral situation.

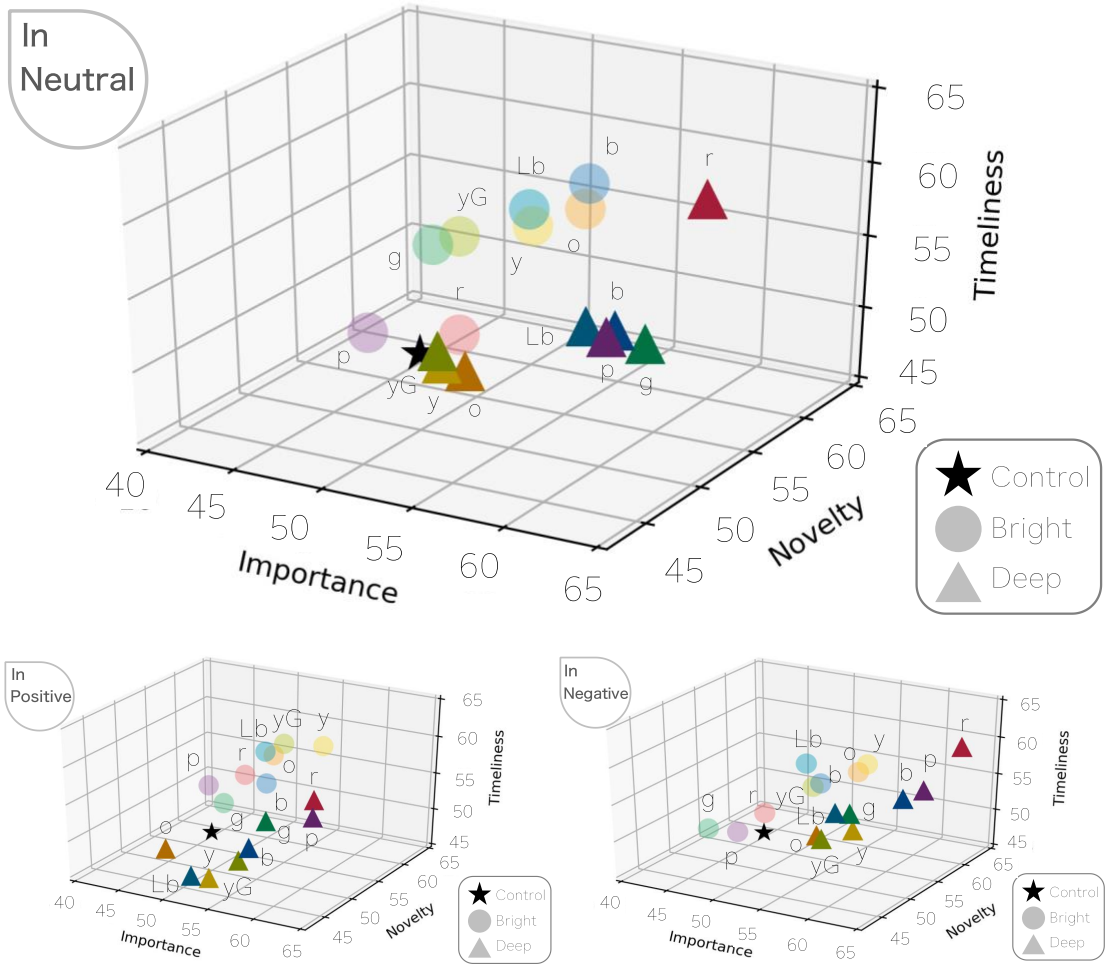


Fig. 53-2 | The integration of three news values in the neutral emotional news context is presented by the space. The spaces of positive (left) and negative (right) are shown in the lower position as conferring information.

Within the neutral context, the news value perception of deep-toned red was slightly lower than that of the negative context, and the overall position moves to the

lower left, and the correlation between importance and novelty dimension was lower, i.e., the directional trend of a single news value ($r_{[I, N]} = .189$, $p = .300$), but the news novelty and news timeliness were integrated to a certain extent ($r_{[N, T]} = .543$, $p = .001$). The deep-toned yellow was very close to the control condition, indicating there was a harmony integration within the neutral context, but limited by the size of effect considering the mean values of the evaluation ($r_{[I, N]} = .537$, $p = .002$; $r_{[N, T]} = .559$, $p < .001$; $r_{[I, T]} = .448$, $p = .010$). Besides, the bright-toned yellow was significantly correlated in terms of the integration of the news novelty and news importance ($r_{[I, N]} = .721$, $p < .001$).

The green by the deep tone was clear in importance dimension, while the green by the bright tone moved diagonally to the upper right, indicating news novelty. Other negative effects, such as news importance, were reduced, and timeliness was moderate. The value integration within green is relatively general in the neutral context.

The blue was similar to green within the deep tone, i.e., the news importance was clear. Also, under the bright tone condition, a remarkable integration of novelty and timeliness was presented ($r_{[N, T]} = .761$, $p < .001$).

The deep-toned orange was closer to the control condition, and the integration of news values was weak. While, the orange color by bright tone expresses the significant correlation between novelty and timeliness by a limited effect in the neutral situation ($r_{[N, T]} = .424$, $p = .016$). The deep-toned yG color was the same as above, and it also integrates the news importance and timeliness as the passive impression feedbacked from part of the participants ($r_{[I, T]} = .499$, $p = .004$). As the bright-toned yG color, the integration of novelty and timeliness was significantly correlated ($r_{[N, T]} = .599$, $p < .001$), which suggests that different tones may have an influence on the expression of news timeliness in emotionless scenes. The deep-toned Lb color almost overlaps with blue. The Lb color by bright tone was the same as above, and it also integrates the news novelty and timeliness, showing a relatively higher correlation ($r_{[N, T]} = .650$, $p < .001$) than that of the negative context.

The purple by deep tone was similar to the blue; hence, it will not be repeated. The purple by bright tone can refer to the performance in the negative context mentioned

above, given its stable performance.

As shown in Fig. 53-3, from the perspective of positive context, within the coordinate, the distribution of all targets visually comes into an S-shaped trend as a slope, toward the lateral oblique direction, given that the perception of the importance dimension tends to be stable. We observed that the integration of novelty and timeliness in the bright tone was better than in the deep tone.

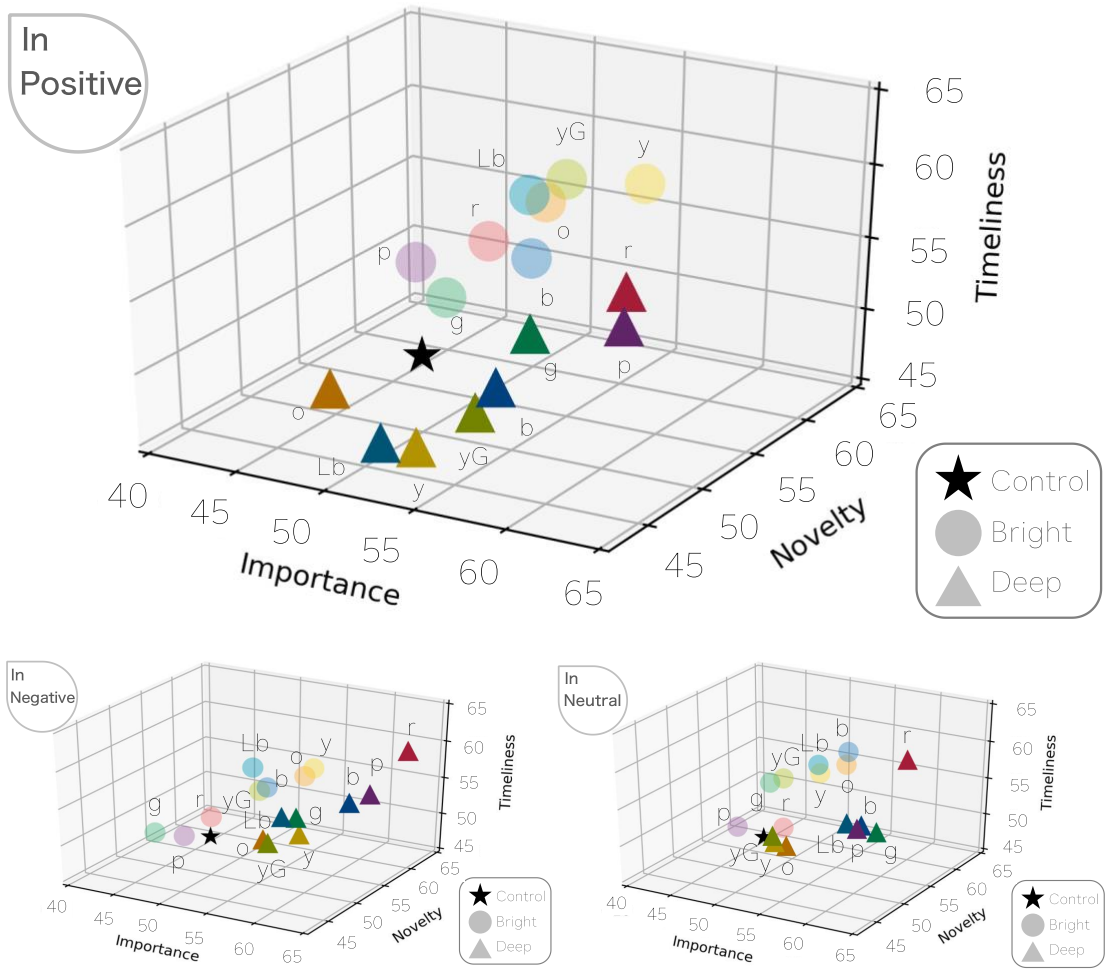


Fig. 53-3 | The integration of three news values in the positive emotional news context is presented by the space. The spaces of negative (left) and neutral (right) were shown in the lower position as conferring information.

The deep tone of red once again shows a tendency to move toward the lower left, and both the news importance and timeliness decreased simultaneously, and the correlation coefficient between the two dimensions was significant ($r_{[I, T]} = .647$, $p < .001$). While the novelty changes little, the integrations with the timeliness and importance after that reduction were significant respectively ($r_{[N, T]} = .550$, $p = .001$; $r_{[I, N]} = .651$, $p < .001$). This indicates that the importance of deep tone is limited to a specific context.

The deep-toned yellow reached the lowest evaluation among all hues in the novelty dimension, and timeliness also appeared a passive effect. The correlation between the two was significant considering the simultaneous reduction ($r_{[N, T]} = .550$, $p = .001$); thus, yellow may not be suitable for integrating these news values. However, bright yellow exhibited the opposite features, and its expressiveness was similar to that of the negative context.

The deep-toned green was better than other hues, except for the same tone red in the news timeliness expression. Also, the correlation between the news novelty and timeliness was significant ($r_{[N, T]} = .559$, $p < .001$). The distribution of bright green locates in the middle of the space, which better balances the integration relatively ($r_{[N, T]} = .758$, $p < .001$; $r_{[I, T]} = .684$, $p < .001$; $r_{[N, I]} = .580$, $p < .001$), although the effect was limited as its moderate mean value.

The blue by deep tone still pointed to importance, whereas the correlation between novelty and timeliness was significant, as the simultaneous reduction ($r_{[N, T]} = .668$, $p < .001$), and the overall degree of integration was slightly lacking. Based on the bright tone, blue points to the integration of importance and timeliness ($r_{[I, T]} = .687$, $p < .001$), with a rare novelty focus; thus, the integration was not sufficient in the positive context. The deep tone of orange inhibited the simultaneous expression of importance and novelty, and timeliness was closer to the control origin. Here, the deep-toned orange made it difficult to integrate news value into the positive context. Regarding the bright tone of orange, novelty, and timeliness had a significant correlation ($r_{[N, T]} = .594$, p

<.001) as we expected.

The deep-toned yG color tended to visually lean toward the base side, which indicates that novelty and timeliness were reduced, although the correlation between them was significant ($r_{[N, T]} = .537$, $p = .002$). Nevertheless, it did not have a reasonable integrity of news value. The position of the bright-toned yG color was higher overall, and its performance was even close to that of yellow. Its novelty performance was not inferior to that of the other hues within the same tone. Its expression of importance was in the upper grade within the intermediate color, and the correlation between news values was significant generally ($r_{[N, T]} = .727$, $p < .001$; $r_{[I, T]} = .555$, $p < .001$; $r_{[I, N]} = .549$, $p < .001$), which suggests that this color condition can achieve the news value integration.

Lb color by the deep tone visually tended closer to the lower part of the front side, which reveals that novelty and timeliness lost their effectiveness, although we observed a significant correlation between them ($r_{[N, T]} = .602$, $p < .001$). The importance of the bright Lb color was the same as that of the deep tone of those mentioned above. Therefore, its performance in the integration of news values was poor.

The deep-toned purple was visually close to the right side of the space, and it shows positive effects on the three dimensions. The correlations between them were significant respectively ($r_{[I, T]} = .702$, $p < .001$; $r_{[I, N]} = .565$, $p < .001$; $r_{[N, T]} = .535$, $p < .001$), indicating that the integration of purple under this situation was relatively feasible. Although purple by the bright tone was a little different from that of the above, it was located above the control and closes toward the inner vertex of the space, which indicates that timeliness and novelty have been enhanced. According to the correlation coefficient, there was a significant correlation between the two dimensions ($r_{[N, T]} = .721$, $p < .001$). Therefore, it can be said that purple can partially integrate news values.

4.4 | DISCUSSION

The effects of OCT color on news value perception were investigated by using the three tones corresponding with eight chromatic hues in the news emotional contexts. The results revealed certain effects of color in the single news value dimension and the integrated situation. We found that the tone of OCT color has a completely different impact on different value dimensions in the specific context, which suggests that not only the hue but also the tone may affect the news value perception in specific journalistic work and practice. Under the specific conditions of color and context, the extent of news value integration indicates that using the advantages of certain colors may effectively facilitate the news value perception, which can promote news transmission and vice versa.

Compared to bright tone, the deep tone may make news scenes perceived more important. This effect was mainly reflected by the negative context and the neutral context, whereas the positive context did not show any significant difference[1], which suggests that the OCT color, especially the tone, may influence the viewer's perception associated with the emotion originating from the content itself. Further, the integration figures show that the news importance was closer to the negative context than to the positive and neutral context by the deep tone OCT, which is in line with the insight, i.e., bad is stronger than good.[5]

Contrary to the importance dimension, the bright tone may make the news perceive more novel than the deep tone. The results show that the mean value of bright tone was higher than that of deep tone. Interestingly, between the two tones, significant differences were observed for red, green, and purple in the importance dimension, while there was no significant difference in the novelty dimension, and the opposite is true for the other hues. Moreover, the distributions of deep-toned red, green, and purple were on the relative right side in the neutral, positive, and even the negative context (see Fig. 53), which indicates that even the OCT with the deep tone, these three hues can still hold the news novelty to certain extent,[7] which is distinctly different from the other deep-toned hues. The performance of bright colors, e.g., the orange and yellow as the main force leading should be considered, and the blue that suddenly rose is

noteworthy. This reveals that warm color such as orange and yellow with bright tone, have better novelty directionality in the news context. As for the cool color, the blue series in bright tone was relatively more suitable for news novelty than deep tone, especially the Lb color.

Unlike the above dimensions that present an obvious unilateral tendency, the timeliness dimension falls into a more complicated blending state, i.e., the mean value of deep-toned red, green, and purple was higher than that of bright tone, while the orange, yellow, yG color, and Lb color by bright tone was higher than the corresponding deep tone. The blue by these two tones almost appeared to overlap. The deep tone performance was extremely consistent with the other two dimensions. The integration analysis also reveals the diversity in which red integrated timeliness and importance in the negative context; green achieved an integration of timeliness and novelty in the positive context; as for purple, the integration of novelty and timeliness was shown in the negative context; and the integration of the three dimensions in the positive context was significant. By contrast, several participants reported that the part of the intermediate hues colored by deep tone made them feel psychologically oppressive; thus, their sensitivity to time perception after the experiment became lost, while the primary hues did not feel that way.

In summary, color can carry meaning,[12] and OCT as a medium may contribute to the achievement of color meaning in the news context. The OCT tone and hue can influence the cognitive differentiation on a single news value dimension and achieve varying degrees integration on multiple news value dimensions simultaneously. This study practically provides an applicable color scheme while discussing the cognitive effects of color in the scope of news. As to whether the more complex situations involved in OCT itself, such as design forms, fonts, and animations, affect the perception of news value, and how the audio-visual coordination involved in OCT in dynamic visual content affects the perception of news value, it is necessary to clarify them in a series of studies and discussions in the future.[31]

CHAPTER 5

| The effects of OCT color on perception of news value in the application context

5.1 | Introduction

Exploring the effects of OCT color on the perception of news value in different contexts is the main purpose of this research. In this section, the issue that whether OCT color has effects on the perception of news value in the the broadcast (BC) and social media (SM) application context was clarified.

Specifically, in this section, the experiment that included three sessions was conducted. For the news importance dimension, a simulation test of channel-changing / screen-scrolling, i.e., the behavior tracking test was conducted to investigate the news importance dimension. For the news novelty dimension, a left or right scene choosing test was designed to investigate the novelty dimension. Regarding the news timeliness dimension, a memory test that consists of different color-time conditions was created to clarify the news timeliness in terms of color use.

In the following, the hypotheses and research questions were proposed according to the session respectively. For the news importance dimension, the alternative hypothesis was adopted, i.e., the importance of news scenes manipulated with color OCT on the same color should be different between the BC context and the SM context because of the differences that exist in the medium itself. The research question for this dimension is that whether the news importance perceptions of the color OCT news are the same in the BC context and the SM context? In other words, does color make different impressions in different media applications?

Concerning the news novelty dimension, does the same color (hue) OCT differ between the news scenes in the BC context and the SM context when performing news novelty? In other words, does the news scene equipped with the same color caption produce differences in the perception of news novelty due to the different application contexts? So far, there are no relevant studies. Thus, the null hypothesis that mainly focuses on the hue was adopted.

Regarding the news timeliness dimension, in the absence of corresponding research, the null hypothesis that mainly focuses on the tone was adopted, i.e., between

the conditions consisting of color (tone) and time, there should be no influence on the perception of news timeliness in different application contexts. Even then, the authors will try to make the following speculations. The vivid tone would be most suitable for high timeliness news, i.e., the news reported by one minute ago. The bright tone would be second, i.e., it is suitable for general timeliness news (news reported by one hour ago). The deep tone would only be suitable for low timeliness news (news reported by one day ago), but previous experiments have suggested that specific OCT colors may have the opposite effects in the certain contexts.

5.2 | Methods

5.2.1 | Stimuli

In this section, besides the images used in the former experiments, two new images of physical media corresponding with the purpose of the experiment were added, i.e., the visual broadcast medium is represented by a television frame and the social media is represented by a smartphone frame. The common part of the experimental stimulus is the OCT pattern colored with eight hues, each of which corresponds with three tones, and the OCT pattern was applied to the three news emotional contexts. Regarding the specific stimuli, it is described in detail below according to their news value dimension.

In the session of the news importance perception, in both the BC and SM contexts, the image stimulus was located at the center of the screen. In the BC context, the image stimulus size is 1235 × 985. In the SM context, the image size is 608 × 847. Since their natural difference in the physical size, it seems to be difficult to achieve the same size for the BC context and SM context. Therefore, the image size in the SM context used in the experiment was slightly enlarged to balance the perception of physical size distortion between the media. It may help participants focus their attention on the news

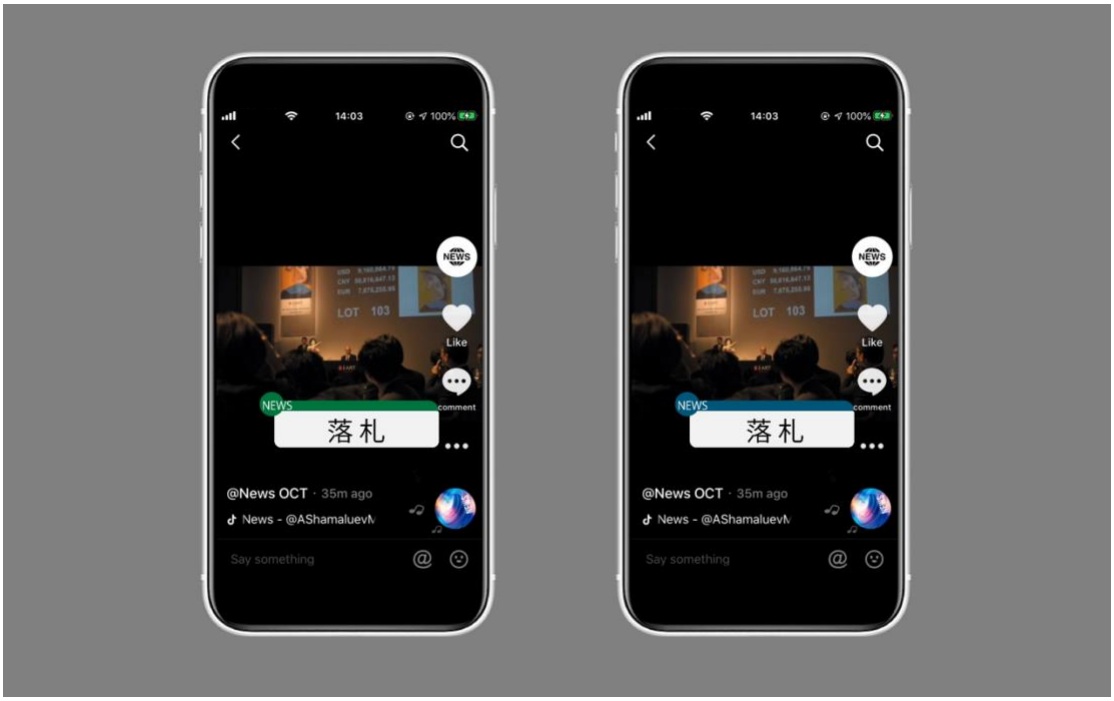
scene itself rather than on the physical appearance of media. Regarding the OCT color configuration, the tones used are bright tone, vivid tone, and deep tone, and the hues used were eight chromatic hues as well as one achromatic hue, totally the 27 colors were used.

(a) (b)

Fig. 54 | The image of stimulus used in the first session, i.e., the perception of the news importance dimension. (a) represents the BC context conditions, and (b) represents the SM context condition.

In the session of the news novelty perception, the two images of BC or SM contexts were processed into the equal size image and placed on the left and right of the screen. In this case, the size of the left and right image for the BC context is 617.5 × 492.5, i.e., one-half the size of the original image. The image size for the SM context is 608 × 847, i.e., the original size of the image. Regarding the settings of OCT colors, two adjacent hues were occluded into eight groups, i.e., R-O, O-Y, Y-YG, YG-G, G-BG, BG-B, B-P, P-R. Each group consists of a primary hue and an intermediate hue, and each group corresponds with three tones, which was randomly presented in combination with the emotional context.

(a)



(b)

Fig. 55 | The image of stimulus used in the second session, i.e., the perception of the news novelty dimension. (a) represents the BC context conditions, and (b) represents the SM context condition.

In the session of the news timeliness perception, the size of the image stimuli is consistent with the novelty dimension. The images of the time nodes were added. There are three images of time nodes, i.e., one minute ago, one hour ago, and one day ago, with the size of 489 × 241.

Fig. 56 | The image of stimulus used in the third session, i.e., the perception of the news timeliness dimension. The left represents the high timeliness time node; the middle represents the general timeliness time node, and the right represents the low timeliness time node, respectively.

5.2.2 | Participants

Twenty-five participants were recruited. There were sixteen males and nine females (25–71 years, *M = 32.08*; *SD = 10.30*). Of all participants, twenty people indicated that they had never participated in similar experiments before. Five people indicated that they had participated in psychological experiments before, all they had participated in experiments similar to the current experiment more than twice.

Of all participants, twenty-two people indicated that they participated in this experiment by wearing colorless and clear myopic glasses, and all of them indicated that they wore myopic glasses on a daily basis. All participants who wore glasses were asked to make sure that the lenses are clear and non-tinted during the experiment. Wearing other eyewear other than for vision correction, including but not limited to sunglasses, etc., was not acceptable in this experiment. Regarding color vision, all participants indicated that they had previously been given and passed the Ishihara test.

Thus, all had normal or corrected-to-normal visual acuity and color vision. The participants were provided with informed consent at the beginning of the experiment.

5.2.3 | Apparatus and Experimental Environment

The experimental period was still at the epidemic stage of the COVID-19. To ensure the safety and health of participants, the experimental process adopted an online style. Thus, the equipment was prepared by the participants themselves.

Some differences with previous experiments, the use of computer was required. Other devices, including but not limited to iPads, will not be accepted in this experiment. Make sure that the computer can access the Internet, and has more than 2GB storage space, as well as there are no system errors.

Specifically, participants were required to adjust their display to RGB settings and to adjust the brightness to make all 21 steps of a grayscale ramp visible. Thereafter, open the website (https://www.psychopy.org) and download PsychoPy, which is available for Mac and Windows, according to their devices. The software itself is free to download, and there are numerous updates available. Through the version description, it can be found a suitable one. Then, they were required that follow the instructions to install the software. Finally, download the zip file (including the 100.psyexp, 200.psyexp, and 301.psyexp, 302.psyexp, 303.psyexp) that was provided by the experimenter. Please inform the experimenter in advance of any of the above uncertainties. When the above operation was executed, the experiment was considered ready.

This experiment required participants to complete in an independent state; thus, it was recommended that participants temporarily keep their phone on silent mode.

5.2.4 | Procedure

When the above steps were ready, the experiment was started according to the operation guide in the instruction document PDF (Japanese and Chinese versions are available). The PDF consists of the path to open the file; how to access the experiment file; how to fill in personal information; the sequence within the experiment; how to give feedback on the experiment results; the contact information of the experimenter. The actual sequence of the experiment was explained separately.

First, open and run the 100.psyexp, i.e., session 100, which was used to examine the news importance perception. As shown in Fig. 57-1, when the personal information was confirmed, the experiment description appears on the screen, i.e., the follows are today's important news, and you can switch channels freely by using the space bar. When getting ready, participants were instructed to press the space bar to start the experiment. When the experiment was entered, a fixation cross appears in the center of the screen for one second. Then, a stimulus image with the BC context, i.e., as the broadcast context appears, and the image stimulus stays for the utmost 20 seconds. Thereafter, participants were required to respond by pressing the space bar within 20 seconds, and if they did not respond within the time limit, the next stimulus image was presented randomly. All OCT hues, tones, and news scene images were randomly presented in the experiment, and the remaining time that participants stayed in each stimulus image was recorded. The number of trials in the BC context is 3 tones × 9 hues × 3 emotional contexts = 81 trials. When all trials in the BC context were completed, a 60-second countdown for a little break starts. As shown in Fig. 57-2, when the countdown ended, the instructions appear again, and the trials of the SM context, i.e., the social application part was started by pressing the space bar. The procedure and number of trials are the same as those for the BC context, and the experiment was finished automatically when all trials for the SM context were completed.

Fig. 57-1 | The procedures of the news importance perception in the BC context

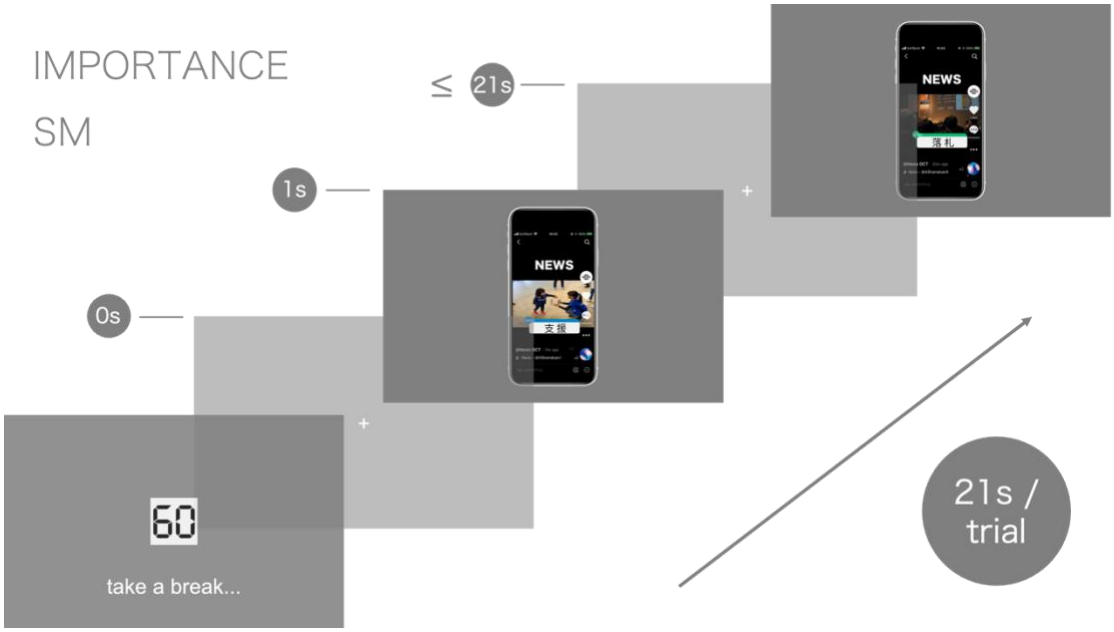


Fig. 57-2 | The procedures of the news importance perception in the SM context

Next is the second session, i.e., the 200.psyexp. As above, after participants

confirmed their personal information, as shown in Fig. 58-1, the instructions appear, saying which news looks more unexpected visually? Respond by using the left or right keys. Once ready, participants were instructed to press the space bar to start the experiment. When the experiment was entered, a fixation cross appears in the center of the screen for one second. Then, a stimulus image with the BC context appears in the center of the screen, and the image stays for one second. This image does not contain OCT and was used only as cue information of the news scene and emotional context. Thereafter, the stimulus of news image with OCT appears on the left and right sides of the screen simultaneously, and the duration of this image was one second. Finally, the screen presents the words that which one looks more unexpected? And, the left and right buttons were accompanied. Participants were required to respond by pressing the left or right button within 20 seconds. If they did not respond within the time limit, the next stimulus image was presented randomly. The button chosen and the reaction time was recorded.

The OCT tone of the left and right images within one trial are the same at a time, and the three tones appear randomly among different stimulus images. The OCT hues that appear on the left and right are different in their properties, i.e., without two primary hues or two intermediate hues appearing at the same time. Further, the news images change randomly every time. The number of trials for the BC context is 3 tones × 8 groups of hues × 3 emotional contexts = 72 trials. When all trials in the BC context were completed, a 60-second countdown for a little break starts. As shown in Fig. 58-2, when the countdown ended, the instructions appear again. The trials in the SM context were started by pressing the space bar. The procedure and number of trials are the same as those for the BC context, and the experiment was finished automatically when all trials for the SM context were completed.

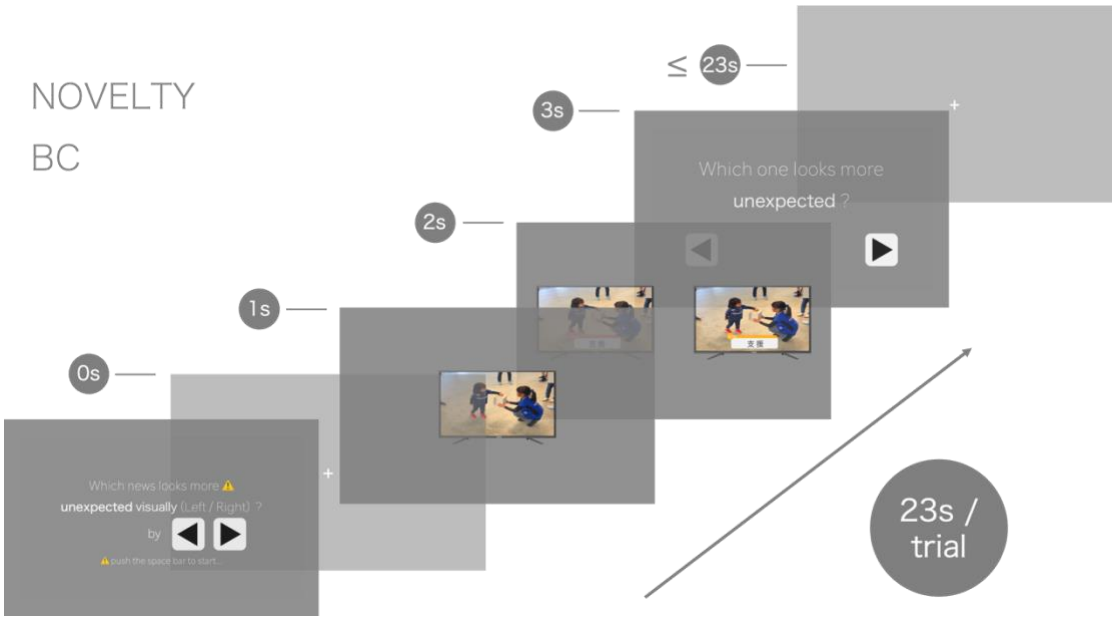


Fig. 58-1 | The procedures of the news novelty perception in the BC context

Fig. 58-2 | The procedures of the news novelty perception in the SM context

The final session, i.e., session 300 is divided into 301.psyexp, 302.psyexp, and 303.psyexp, which has the same internal structure. The difference is that each of the

three programs corresponded to three experimental conditions, i.e., the color-time settings (see the table below). Participants were instructed to choose one from the three programs (301.psyexp, 302.psyexp, 303.psyexp), and it should be noted that they do not need to participate in all of them.

Group	1m	1h	1d
301	Bright	Vivid	Deep
302	Vivid	Deep	Bright
303	Deep	Bright	Vivid

Table | The conditions are corresponded to the three groups of participants

After participants confirmed their personal information, the instructions appear on the screen as shown in Fig. 59-1, i.e., first, remember the specific news scenes at the following time nodes (1 minute, 1 hour, and 1 day) as much as possible. Then, answer the recall test as quickly and accurately as possible. The answer method is shown in the figure below. The scale of time node appears in the lower middle part of the instruction page, and was used as follows: first, tap and hold to drag the blue inverted triangle left or right to the appropriate position on the scale; second, confirm by tapping the box below the scale. Once ready, press the space bar to start.

Take program 301 as an example, the encoding part is without the application context, a fixation cross appears in the center of the screen for one second. Then, a news image appears randomly in the center of the screen, and after 500ms, a time node box corresponding to the OCT tone appears on the news image, and this scene lasted for one second. At the end of such an entire circular encoding part, the recall process begins. The number of trials for the BC context is 3 groups of tone-time pair × 8 hues × 3 emotional contexts = 72 trials, in which the 4.5 seconds is needed for a single scene memory; thus, the time spent for the whole encoding part is about 4.5 seconds × 72 trials = 5.4 minutes. At the end of the encoding, a 60-second break was counted down.

When the countdown ended, the instructions reappear, and the participants confirmed it before starting the recall test.

The recall test for the BC context is first, as shown in Fig. 59-2, where a fixation cross appears in the center of the screen for one second. Then, a news image with a colored OCT appears in the center of the screen with a duration of one second. Thereafter, a time scale was presented at the bottom of the screen, and participants were instructed to respond through the scale within 20 seconds. If they did not respond within the time limit, the next recall trial was started randomly. The time node chosen and reaction time were recorded. When all trials in the BC context were completed, a 60-second countdown for a little break was started. As shown in Fig. 59-3, when the countdown ended, the instructions appear again, and the trials of the SM context, i.e., the social application context were started by pushing the space bar. The procedure and number of trials are the same as those for the BC context, and the experiment was finished automatically when all trials for the SM context were completed. Finally, participants were instructed to send data to experimenter. This session was considered to be finished.

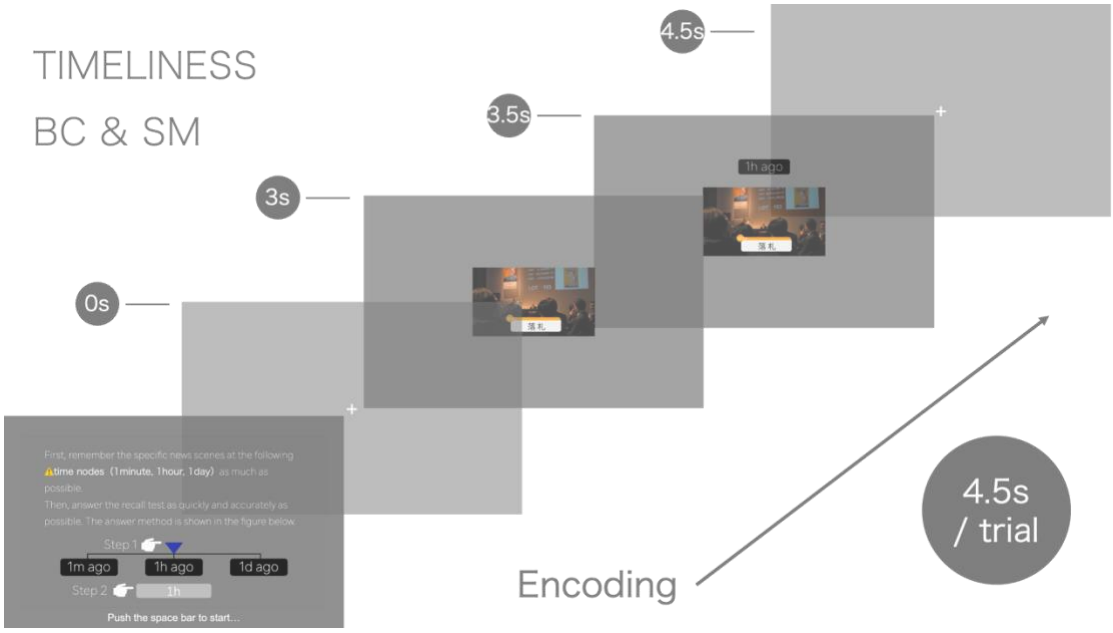


Fig. 59-1 | The procedures of the news timeliness perception in the encoding stage of memory

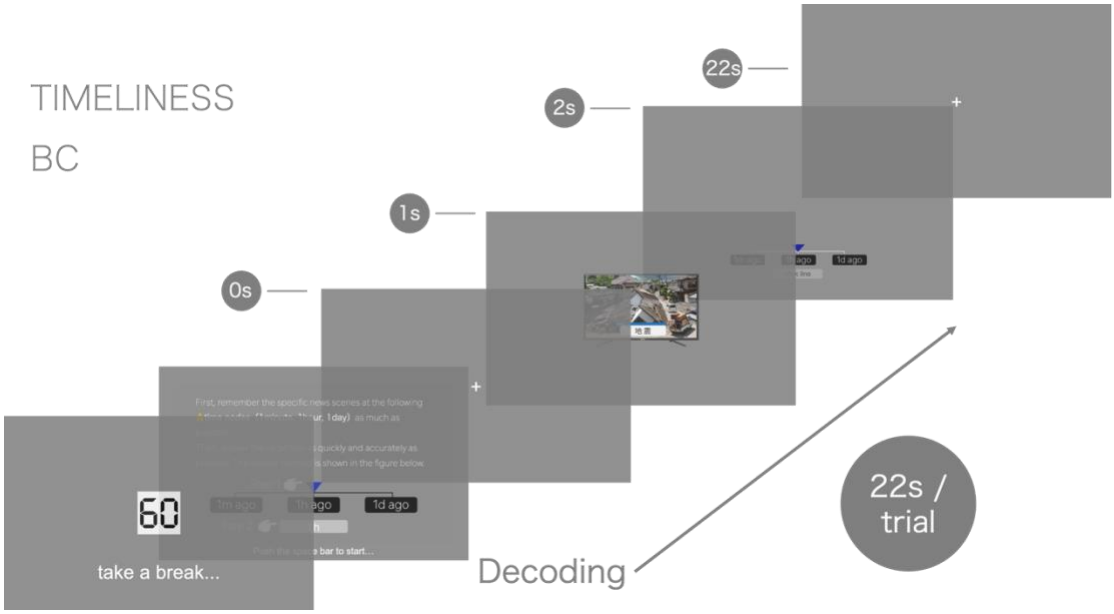


Fig. 59-2 | The procedures of the news timeliness perception with the BC context in the recall stage of memory

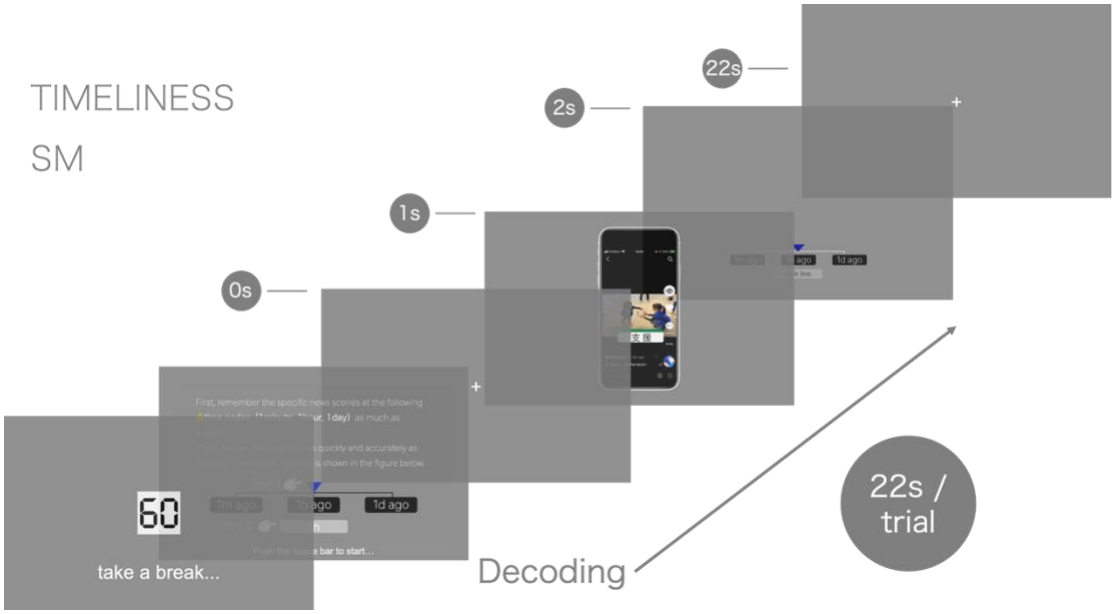


Fig. 59-3 | The procedures of the news timeliness perception with the SM context in the recall stage of memory

5.3 | Results

5.3.1 | The results of the news importance dimension

Based on the experimental design, a repeated measures ANOVA for the news importance dimension was conducted. The main effects are as follows. The application context manipulation was significant (F [1, 24] = 4.359, p =.048), and a significant difference was observed between the two media (t = 2.088, p =.048), i.e., the time remained in the BC context longer than the SM context. A significant difference was observed for the tone processing (F [2, 48] = 15.024, p <. 001), and significant differences were observed between all three tones. Specifically, news scenes configured with the bright tone OCT significantly made lower news importance perceived than news scenes with the vivid tone OCT (t = -5.458, p <.001) and with the deep tone OCT (t = -3.167, p =.005). The news scenes with the vivid tone OCT show higher news

importance than news scenes with the deep tone OCT (t = 2.291, p = .026). This is different from the results of previous experiments, in which the results suggests that news scenes containing the deep-toned OCT can make news perceived more important. This is most likely due to the arrangement that the given application contexts in this experiment section, i.e., the new conditions, made the stimuli images closer to the actual news, and the experimental method may also have led to the generation of the cognitive differences.

Significant differences were observed between the manipulations of hues (F [8, 192] = 47.625, p <.001), i.e., all of the OCT conditions with chromatic hues in the stimulus scenes were significantly stronger than achromatic hues. Significant differences were observed between red and most chromatic hues, except for orange and BG. No significant differences were observed between the manipulation of orange and BG. The manipulations of yellow and YG were at the same level. The manipulations of YG and green were at the same level. No significant differences were found between green and blue, purple. The manipulations of blue and purple were the same. Except for the above hues, the remaining chromatic hues were significantly different from each other. Besides, significant differences were also observed between the news emotional contexts (F [2, 48] = 44.596, p <.001). The news scenes that perceived neutral emotion were significantly less important than the news scenes with negative emotion (t = -8.532, p <.001), whereas it was similar with positive emotion scenes (t = -7.60, p =.451). Besides, news scenes perceived as negative emotion were considered as more news important than news scenes with positive emotion (t = 7.772, p <.001).

The interaction is detailed as follows. Significant differences were observed for the interaction between color (both hue and tone) and application context (F [16, 384] = 2.702, p <.001). As shown in Fig. 60, participants in the BC context remained significantly longer in scenes with deep-toned red OCT (t = -13.031, p <.001) and vivid-toned OCT (t = -10.883, p <.001) than in scenes with bright-toned OCT. The orange OCT by vivid tone had a significantly longer retention time than the scenes by the deep-toned OCT (t = 9.998, p <.001), while no significant difference was observed with the scenes by the bright-toned OCT; the bright tone had a significantly longer retention

time than the scenes by the deep-toned OCT (t = -3.934, p <.001). Yellow was at the lower level of the primary hues, with no significant differences observed between tone manipulation within its hue.

Overall, the retention time of the YG and yellow scenes was similar, but the retention time of the vivid-toned OCT scenes was significantly longer than that of the deep-toned OCT scenes (t = 4.482, p =.007). Regarding the green OCT, the retention time of the bright-toned scenes was significantly less than that of the deep-toned scenes (t = -6.866, p <.001), and the retention time of the vivid-toned OCT scenes were also significantly less than that of the deep-toned OCT scenes (t = -7.917, p <.001). Regarding the BG OCT, the retention time of the three-tones OCT scenes was very similar and no difference was observed between them.

Regarding the blue OCT, the retention time of the bright-toned OCT scenes was significantly less than that of the vivid-toned OCT scenes (t = -5.352, p <.001) and the deep-toned OCT scenes (t = -4.874, p =.001). Considering the purple OCT, it was roughly similar to blue, i.e., the retention time for the bright-toned OCT scenes was significantly less than for the vivid-toned OCT scenes (t = -5.824, p <.001) and the deep-toned OCT scenes (t = -5.884, p <.001). Regarding the achromatic color, i.e., the control condition, participants' retention time in the scenes with three-tones OCT was generally lower than the above-mentioned chromatic color OCT scenes.

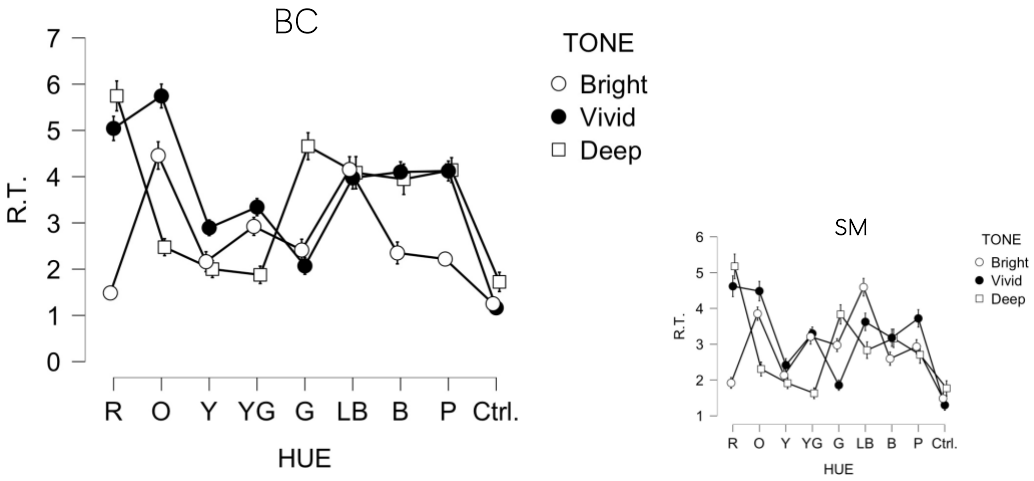


Fig. 60 | The retention time for the news importance perception in the BC context with the color OCT (The SM context as confer on the right side)

As shown in Fig. 61, in the SM context, concerning the news scenes with red OCT, only the retention time in the deep tone was slightly lower than in the BC context, and the remaining performance was closer to that in the BC context, i.e., the retention time of scenes by the deep-toned OCT (t = -9.955, p <.001) and vivid-toned OCT (t = -8.256, p <.001) was significantly longer than that of by the bright-toned OCT. Considering the news scenes with orange OCT, the vivid tone had a significantly longer retention time than the scene with the deep tone (t = 9.998, p <.001); the bright tone had a significantly longer retention time than the scene with the deep tone (t = -4.723, p =.003). Yellow was at a lower level in the primary colors, even weaker than in the BC context, and only slightly stronger than the control group, and no significant differences between tone manipulation were observed within its hue.

Regarding the news scenes with YG color OCT, the retention time in the vivid-toned OCT condition was significantly longer than in the deep tone condition (t = 4.482, p =.007), and unlike the BC context, the retention time in the bright-toned OCT condition was also significantly longer than in the deep tone condition (t = 4.832, p

=.002). Regarding the news scenes with green OCT, the retention time of the bright tone scenes increased the in the BC context. The overall distribution between the tones shows a decentralized tendency. The retention time of the vivid tone was significantly less than that of the deep tone (t = -6.047, p <.001).

Considering the news scenes with BG color OCT, there was a more balanced difference between the three tones, with the duration of the bright tone being significantly longer than that of the deep tone (t = 5.374, p <.001), which is very different from the BC context. Regarding the blue OCT, there was little difference between the tones, and the retention time was moderate, which is somewhat different from the previous measurement by the SD method. For the news scenes with purple OCT, the overall retention time was longer than for blue, and the vivid tone was more eye-catching. Regarding the achromatic color, i.e., the control condition, participants' retention time in the three tones was generally lower than the above-mentioned colored scenes, and entirely less than the BC context.

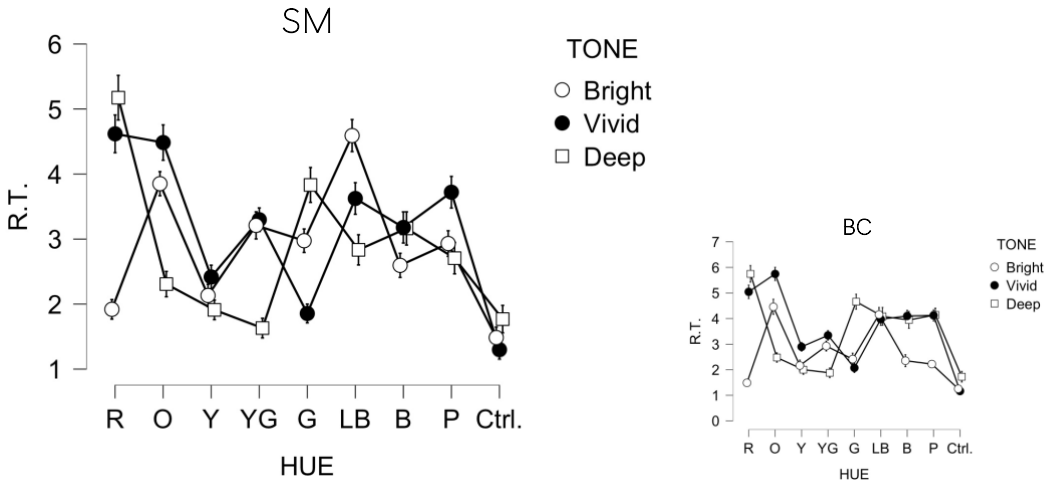


Fig. 61 | The retention time for the news importance perception in the SM context with the color OCT (The BC context as confer on the right side)

As shown in Fig. 62, about news importance perception, some differences were observed between the retention time of the BC context and the SM context across color configurations. Red significantly differed between tones but was rarely affected by the application context. Orange differed significantly between tones, i.e., the vivid tone condition in the BC context had a slightly longer retention time than in the SM context (t = 4.092, p = .041), and was at the high level of the hues overall. Yellow was unaffected by color and application context and was at the lower end of the primary color. It may be mainly because that the display's color rendering mode is a mixture of three primary colors, i.e., all colors are generated by the RGB. Thus, yellow is a generative color within the four primary colors. Also, some participants in the previous experiment reported that using yellow alone resulted in poor discrimination.

YG color OCT shows a little significant difference in retention time between the two application contexts, but some subtle features between the tone, such as participants in SM session were slightly longer than BC session for the bright-toned YG color OCT, while the opposite is true for the deep-toned OCT. Green also had similar characteristics to the YG color, but differed greatly between the tone levels. Green was at the middle level in the bright tone, at the low level in the vivid tone after the control condition.

The BG color had a significant difference in retention time in the deep tone OCT, i.e., the BC context was significantly longer than the SM context (t = 4.065, p = .046). Besides, BG performed strongly in the bright tone, even with a slightly longer retention time than orange, and with a longer retention time in the SM context than in the BC context, which suggests that bright-toned BG color can be a better indicator of news importance in the SM context. This was consistent with the results of previous experiments. Blue performed relatively moderately in all tones and no extreme differences were observed, which is consistent with the results of previous experiments. Purple was closer to blue overall, but a significant difference between application contexts was observed, i.e., a longer retention time in the BC context than in the SM context in the deep tone OCT (t = 4.666, p =.004). The control condition was inferior to the color condition, and no significant differences were seen between application

contexts. Furthermore, overall, participants in the bright tone configuration had a longer retention time in the SM context than in the BC context.

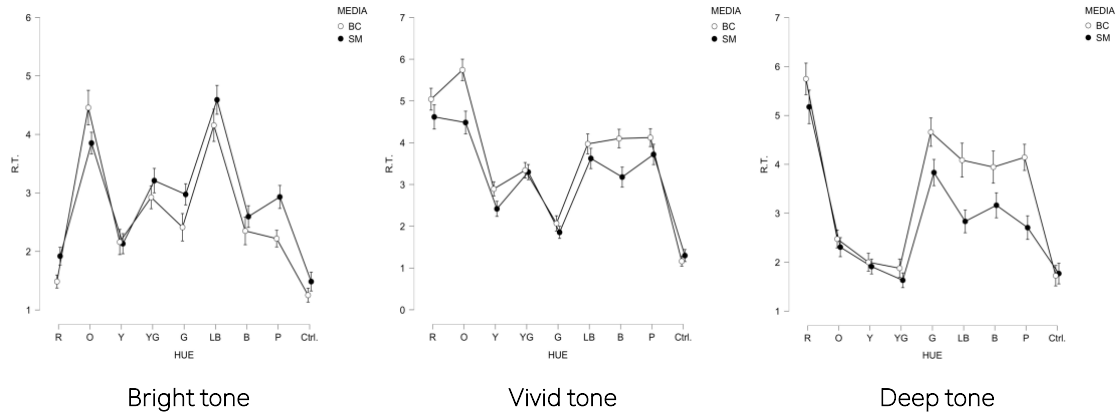


Fig. 62 | The comparison of two application contexts on the news importance perception from the tone perspective

Significant differences were observed in the interaction between color (including hue and tone) and news emotional context (F [32, 768] = 2.908, p <.001), which suggests that the OCT with different colors can make news importance change even in the same news emotional context. The effectiveness of the same OCT color can also vary in different news emotional contexts. As shown in Fig. 63, in the negative emotional context, regarding the news scenes with red OCT, the retention time of the bright tone was significantly less than that of the vivid tone (t = -11.099, p < .001) and deep tone (t = -14.349, p < .001). Referring to the confer graph, red performed roughly the same in the neutral emotional context as in the positive emotional context, only staying longer on average in the negative emotional context.

Concerning the news scenes with orange OCT, a significant difference was observed in the negative emotional context with an evenly separated duration of stay

for all three tones, i.e., the duration was significantly less for the bright tone scene than for the vivid tone scene (t = -4.326, p = .034), but significantly longer than for the deep tone scene (t = 4.703, p = .006).

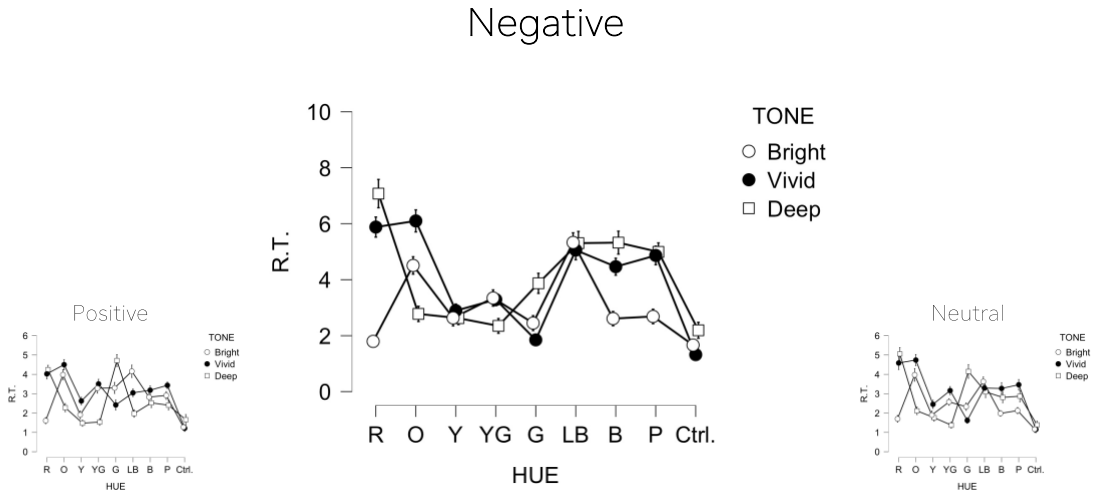


Fig. 63 | The retention time for news importance perception in the negative emotional context

As shown in Fig. 64, the situation in the neutral emotional context was similar to that in the negative emotional context, but the mean value of the duration was lower than that in the negative emotional context. Compared to the other chromatic hues, the yellow OCT had the shortest overall retention time in the scenes of the three emotional contexts. YG color OCT had the retention time of no more than 4 seconds in the scenes of each emotional context, where the overall difference in retention time in the negative emotional context was small, i.e., just subtle mean difference was observed between the three tones; in the neutral and positive emotional contexts, without differences in retention time was observed between the bright and vivid tone scenes, and they were observed to be significantly different from the deep tone scene, i.e., the retention time

of vivid-toned OCT scene was significantly longer than that of deep-toned OCT scene in the neutral emotional contexts (t = 4.858, p = .003); in the positive emotional contexts, the conditions of the vivid tone (t = 5.359, p <. 001) and bright tone (t = 4.749, p =.005) show significantly longer retention time than the stimulus scene with deep-toned OCT.

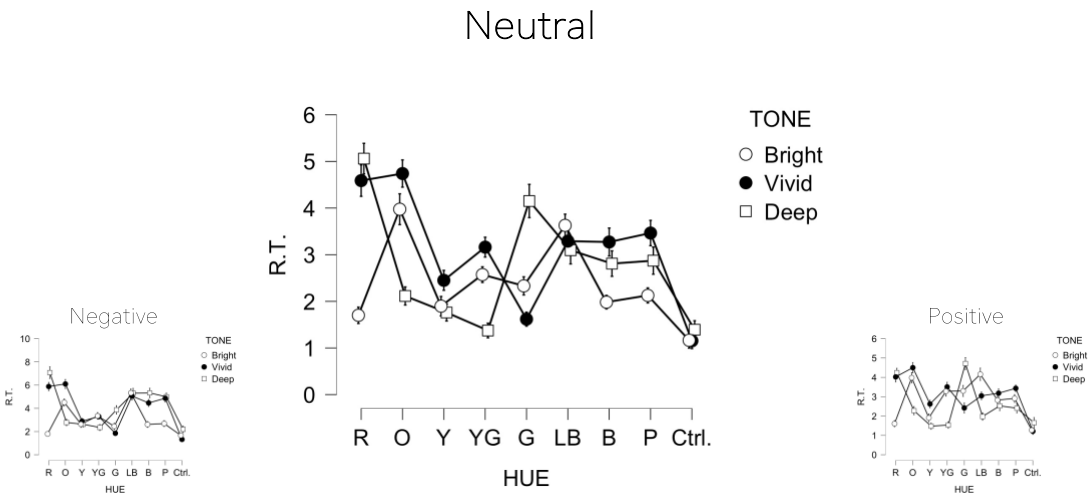


Fig. 64 | The retention time for news importance perception in the neutral emotional context

As shown in Fig. 65, green was the most congruent in the positive emotional context, especially in the deep-toned scene with the longest retention time observed, and this was also the case in the neutral context. However, in the negative emotional context, green was much worse than the other two emotional contexts overall. Specifically, in the neutral emotional context, the bright (t = -4.945, p = .002) and vivid (t = -6.884, p < .001) tone OCT scenes show significantly less retention time than deep-toned OCT scene; in the positive emotional context, the vivid-toned OCT scene had significantly less retention time than the deep-toned OCT scene (t = -6.239, p <.001),

whereas no difference was observed between bright-toned and deep-toned OCT scenes.

Concerning the BG color OCT scenes, the retention time of the three tones was almost identical in the negative and neutral emotional context, which shows the stability of the color in specific emotional contexts. In terms of average performance of the tones, it was even better than red and orange in the negative and neutral emotional contexts. As shown in Fig. 65, only in the positive emotional contexts did the difference in duration between tones arise, i.e., the retention was significantly longer in the bright-toned OCT scene than in the deep-toned OCT scene (t = 5.934, p < .001). It is noteworthy that this is a hue with the longest retention of the bright tone, which suggests that the bright-toned BG color has certain significance for the news importance performance.

Concerning the blue, each emotional context and tone shows balanced performance, which is consistent with the results of previous experiments; thus, its stability was clarified. As for purple, the retention time of deep-toned OCT and vivid-toned OCT scenes was significantly longer than that of bright-toned OCT scenes in the negative emotional context (t = -6.866, p < .001), and the manipulation effects were at the middle to the upper level. In both neutral and positive emotional contexts, the retention time of vivid-toned OCT scenes was superior. Interestingly, in the neutral emotional context, the retention time of the deep-toned OCT scene was at the second place after the vivid-toned OCT scene, while in the positive emotional context, the duration of the bright-toned OCT scene was at the second place after the vivid-toned OCT scene. It can also reveal the association between color and emotional context.

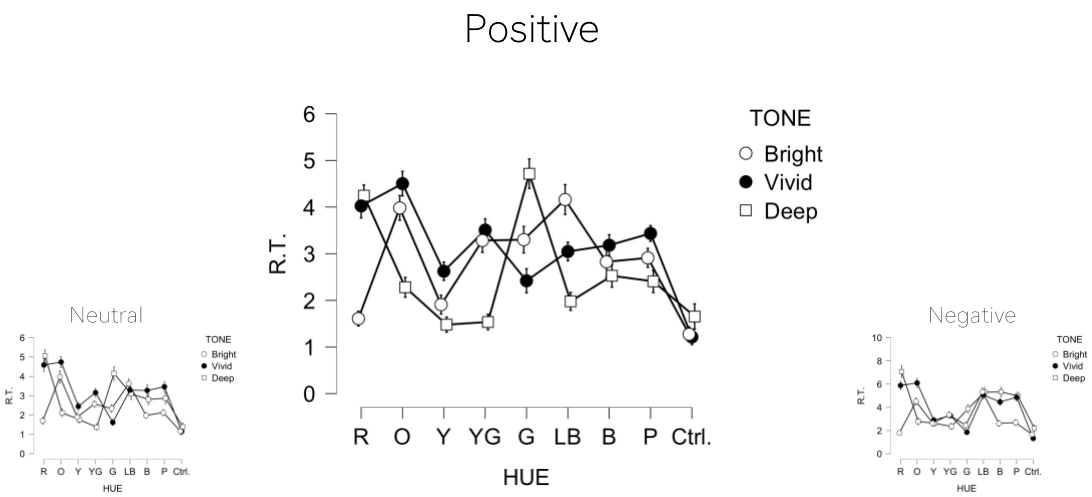


Fig. 65 | The retention time for news importance perception in the positive emotional context

In addition, the retention time on the news scenes that were perceived different emotions indicates that the retention time of the news with negative emotion was longer than news with neutral emotion and news with positive emotion. The average retention time difference between news with neutral emotion and news with positive emotion was not significant. This result was consistent with the theory that bad is stronger than good in terms of news value, i.e., negative news is more attractive to the viewer than positive news (Fig. 66).

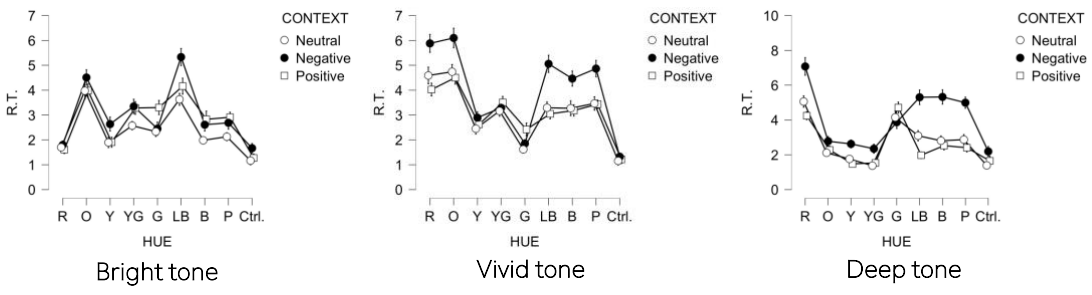


Fig. 66 | The news importance perception reflected by the comparison of retention time in the three emotional contexts

5.3.2 | The results of the news novelty dimension

To simulate the actual situation of news watching, the cognitive differences in perceptions of the news novelty were observed through the OCT color manipulation in the news scenes. In this experiment session, as shown in Fig. 67, for choosing the left or right stimulus scene, only mean differences were observed between the two application contexts within the same hue, without further significant differences, which indicates that the media maybe not be the main factor in the perception of the news novelty. However, the obvious cognitive differences were grasped between hues. Participants were not provided anything about the way hue and tone were configured when the experiment was conducted, yet the results were somewhat consistent with the previous experiments evaluated by the SD method.

Regarding the news novelty perception in this session, the selection rate (S.R.) can be formulated as the ratio between the number of people who chose one of the two news scenes from the left or right scene and the total number of people who participated in the experiment as a standard was considered to be employed. Specifically, as shown in Fig. 67, the choice of red OCT scenes remained around 50% in both application contexts, regardless of news content. In other words, half of the participants thought that news scenes containing red OCT can perceive more novel than news scenes with adjacent color (purple or orange) OCT, and vice versa.

In both application contexts, the selection of orange OCT scenes remained at around 75% regardless of news content, which is the highest selection rate of all tones; thus, around three-quarters of the participants thought that news scenes containing orange OCT were more novel than news scenes in the adjacent colors (red and yellow) OCT. The reason for such a high selection rate of orange maybe because it draws on the respective strengths of red and yellow as an intermediate hue, i.e., red has eye-catching and attention-grabbing effects, and yellow has similar effects in terms of reminders and attention; and some participants indicated after the experiment that orange OCT blends more naturally with the news background color than the primary hues. Regarding the yellow condition, it was the lowest among all the hues, with only

20% of the participants considering the news scenes with yellow OCT to be more novel than the neighboring orange and YG colors. It was mainly because that besides yellow as a generated primary hue mentioned in the importance dimension and it was the highest brightness color. It can be considered as an advantage, but its high brightness caused OCT to be out of harmony with the news background color; thus, it was unsuitable for news novelty.

Regarding the YG color, a non-significant difference was observed in the mean between the two application contexts, i.e., more participants in the SM context than in the BC context thought that the YG color OCT can perform news novelty, with the overall difference between the two was around 60%. In other words, more than half of the participants thought that news scenes with the YG color OCT were novel. Concerning the green condition, a non-significant difference in mean values was shown between the two application contexts, with the BC context being on the same level as the red color overall, i.e., with a selection rate of about 50%; while the SM context was slightly lower than the BC context, at around 45%. It can be seen that the novelty of news scenes containing green OCT seems to be more inclined to be presented in traditional application contexts.

As for the BG color, it was generally better than the primary hue, but it was at the lower position of selection rate in the intermediate hue series, about 60%, which was roughly at the same level as the YG color. Regarding the blue, in the news novelty perception, only slightly more participants thought that news scenes with blue OCT were novel than the yellow condition, i.e., most participants felt that news scenes manipulated with blue OCT did not increase the news novelty, which was consistent with the results of previous experiments. For purple, it was greater than most hues except orange, i.e., nearly 70% of participants found news scenes with purple OCT more attractive, comparing its adjacent colors blue and red, which was similar to the results of some of the previous experiments.

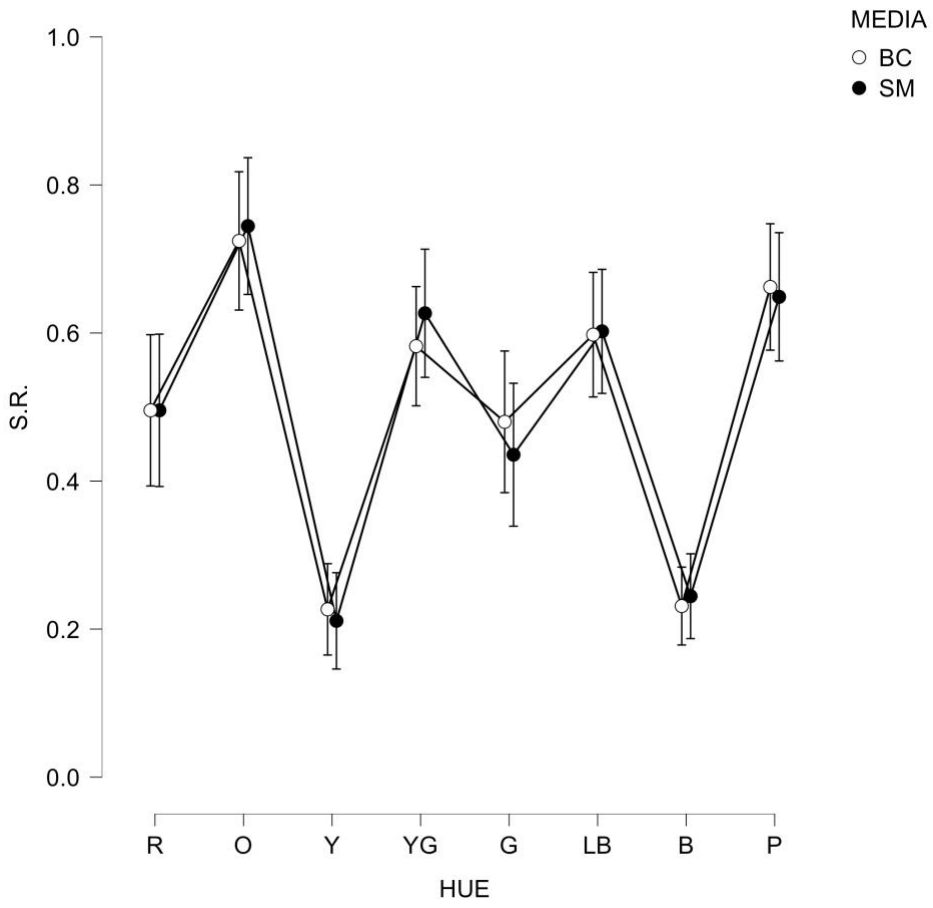


Fig. 67 | The news novelty perception reflected by the selection rate in the two news application contexts

The specific performance of the BC context and SM context in the news emotional context was as follows (Fig. 68–70). As shown in the tree chart, the interior of each chart can be divided into three parts, with the bright tone on the left, the vivid tone in the middle, and the deep tone on the right. Within each tone block, from upper left to lower right, the square area represented by the hue gradually decreases, i.e., the selection rate of news scenes containing that color gradually decreases, and the brackets after the corresponding selection rate indicate the adjacent colors in the hue pairs. This figure aims to explore a feasible solution for achieving the news novelty in journalistic practice. The figures have various functions, e.g., which OCT colors can be used to achieve the news novelty in a given scene, or which OCT colors may cause a potential

inhibition of news novelty performance. In short, it can be regarded as an attempt to propose a systematic solution in this research.

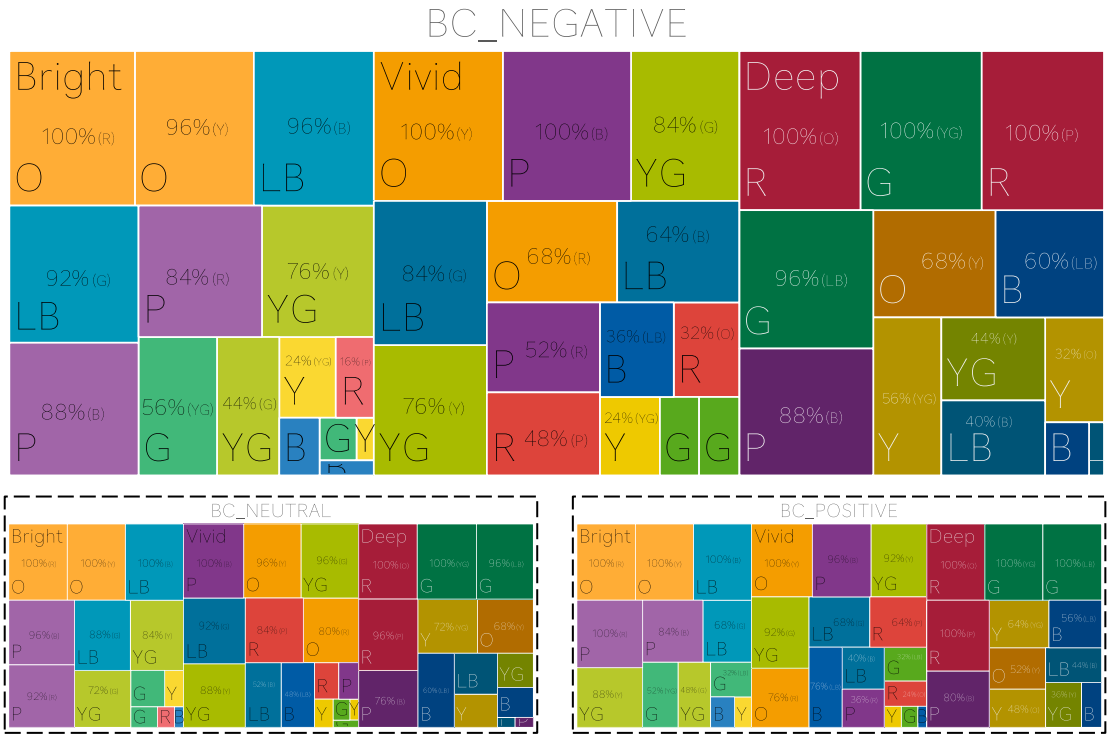


Fig. 68-1 | The color selection rate for news novelty perception in the broadcast and negative contexts (based on the news scene containing OCT)

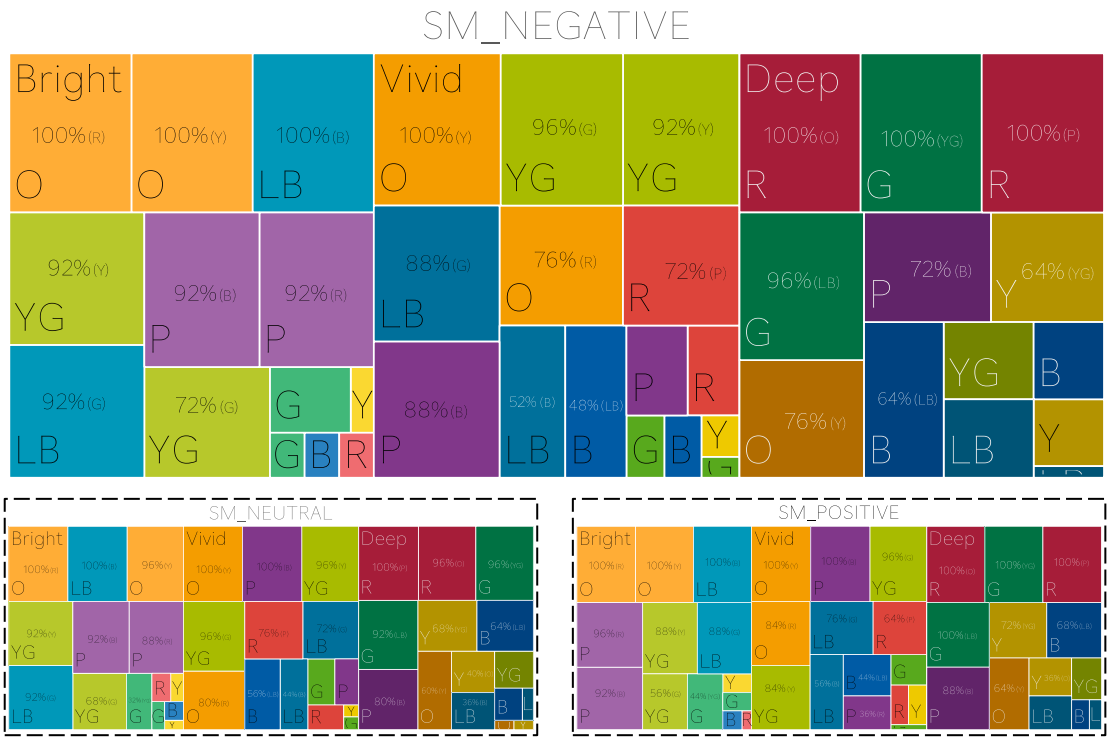


Fig. 68-2 | The color selection rate for news novelty perception in the social media and negative contexts (based on the news scene containing OCT)

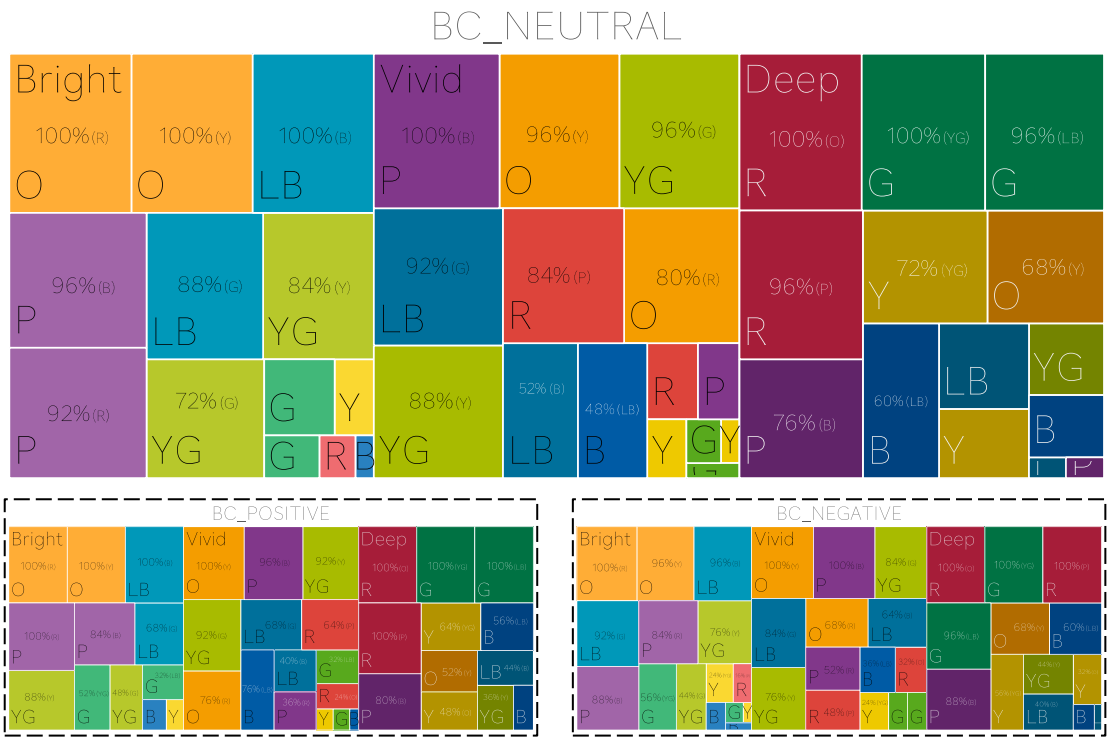


Fig. 69-1 | The color selection rate for news novelty perception in the broadcast and neutral contexts (based on the news scene containing OCT)

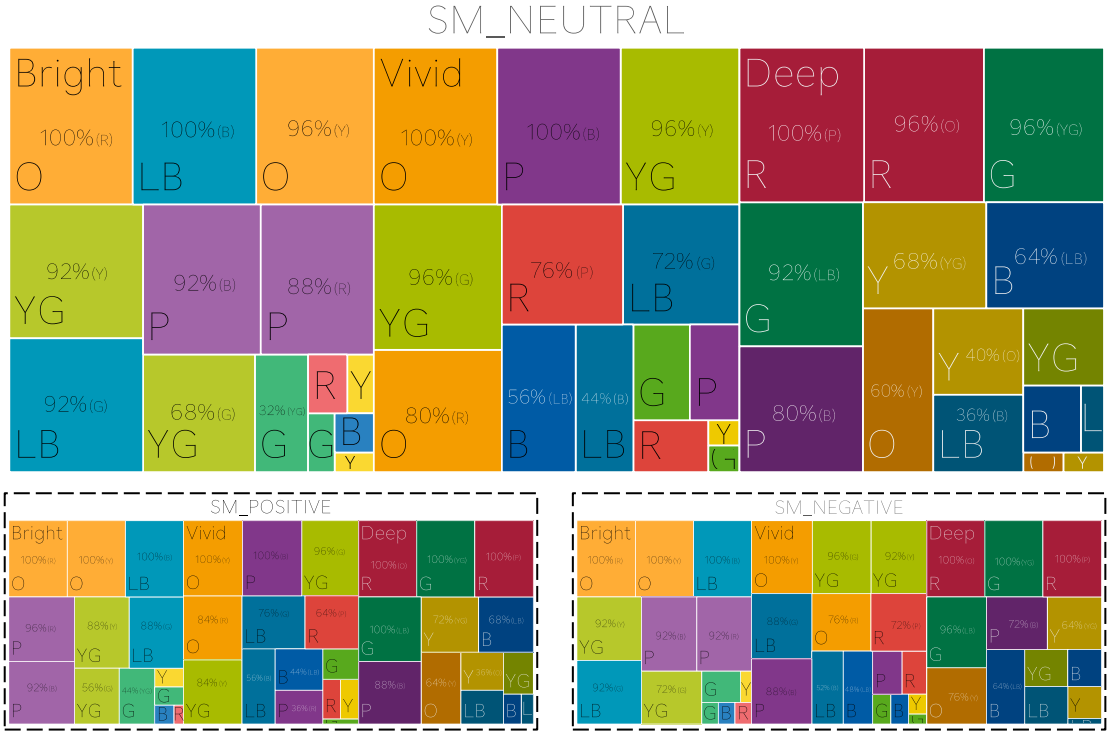


Fig. 69-2 | The color selection rate for news novelty perception in the social media and neutral contexts (based on the news scene containing OCT)

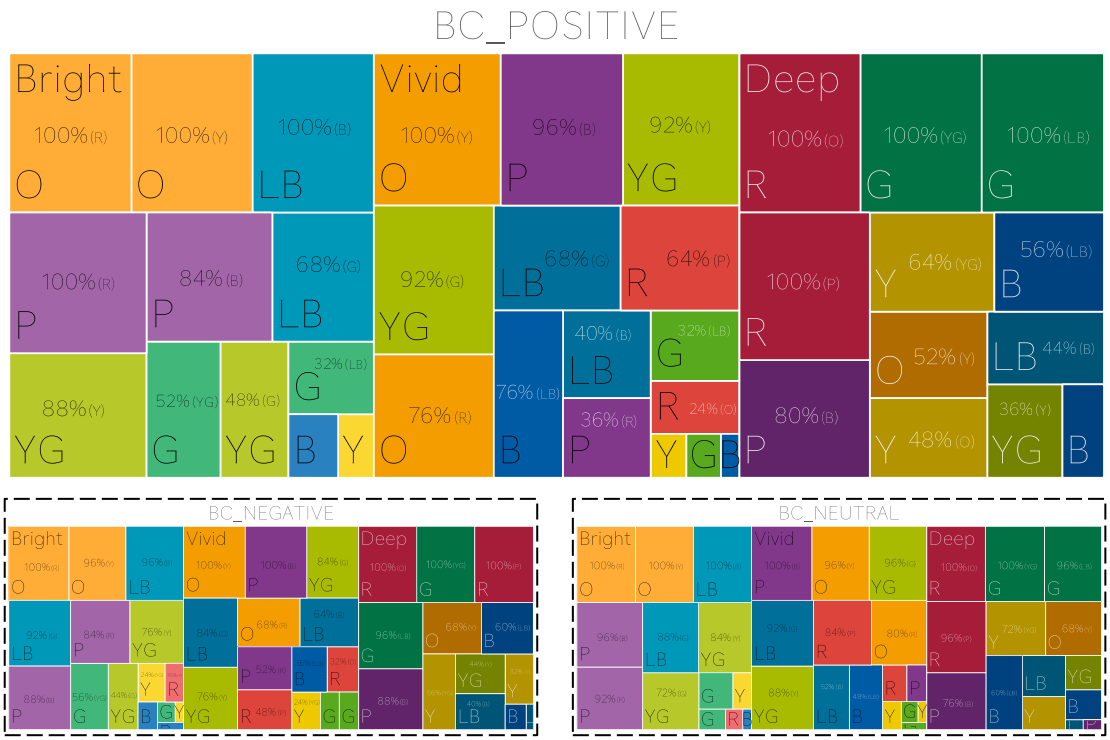


Fig. 70-1 | The color selection rate for news novelty perception in the broadcast and positive contexts (based on the news scene containing OCT)

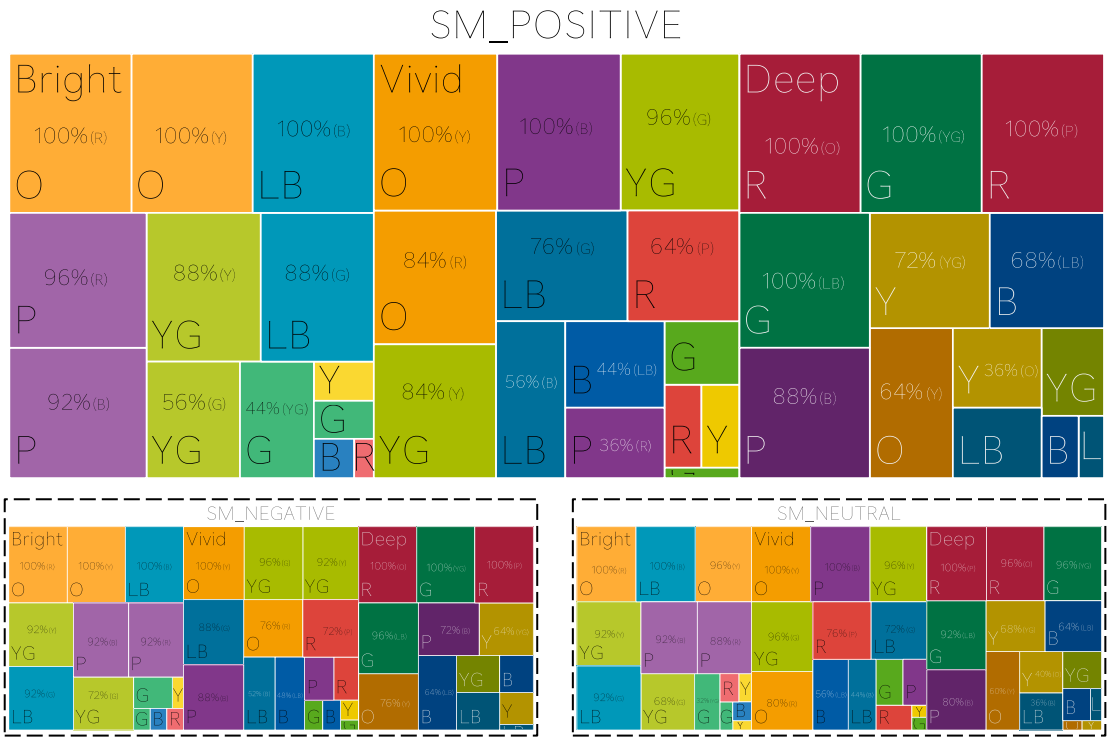


Fig. 70-2 | The color selection rate for news novelty perception in the social media and positive contexts (based on the news scene containing OCT)

On the relationship between news scene selection and OCT color, the effects of color on news novelty perception can be better determined by measuring the response time (R.T.) of the corresponding scene combined with the selection rate. Accordingly, the repeated measures ANOVA was conducted to reveal more detail about the news novelty perception. Significant differences were observed in the interaction between application context and news emotional context and tone (F [4, 96] = 3.260, p = .015), and a significant difference was observed in the interaction between application context and tone (F [2, 48] = 4.160, p = .022). Significant differences were observed for the interaction between tone and hue (F [14, 336] = 15.790, p < .001). In addition, most of the individual factors show main effects, with differences between application contexts (F [1, 24] = 7.997, p = .009), between tones (F [2, 48] = 3.732, p = .031), and between hues (F [7, 168] = 4.845, p < .001). The news novelty of the three images themselves did not lead to differential perceptions.

As shown in Fig. 71, there were differences in reaction time between the BC context and the SM context, some of which were found to be significant. Specifically, within the BC context, the R.T. of deep-toned OCT scenes for the same hue pair took longer than the bright tone (t = -3.142, p = .027) and the vivid tone (t = -3.188, p = .025) conditions, which implies that participants took longer to decide which of the two news scenes looked more novel, perhaps neither was novel enough, or perhaps both made the participants' eyes pop, and the detailed results of this choice need to be analyzed in the context of the later graph. Moreover, there was a significant difference in the reaction time of the deep tone between the BC and SM contexts, i.e., the BC context was significantly longer than the SM context. Between the two application contexts, the vivid tone condition shows the least difference, while the bright tone was moderate.

When breaking down the performance in the news emotional contexts, in the news

scene with negative emotional contexts, as the OCT tone changed from bright to deep, the decision time for the BC and SM contexts diverged, i.e., the time required for the BC context was increasing, while the time required for the SM context was decreasing. In the news scene with positive emotional contexts, the decision time for both BC and SM contexts gradually became longer as the OCT tone changed from bright to deep, and a significant difference was observed between the two in the deep tone, i.e., the BC context required a longer decision time than the SM context (t = -3.188, p = .025). In news scenes with neutral emotional contexts, the BC and SM contexts performed more interleaved in scenes with a different tone of OCT, with the overall BC context preferring the vivid tone and the SM context taking shorter judgment times in the bright tone.

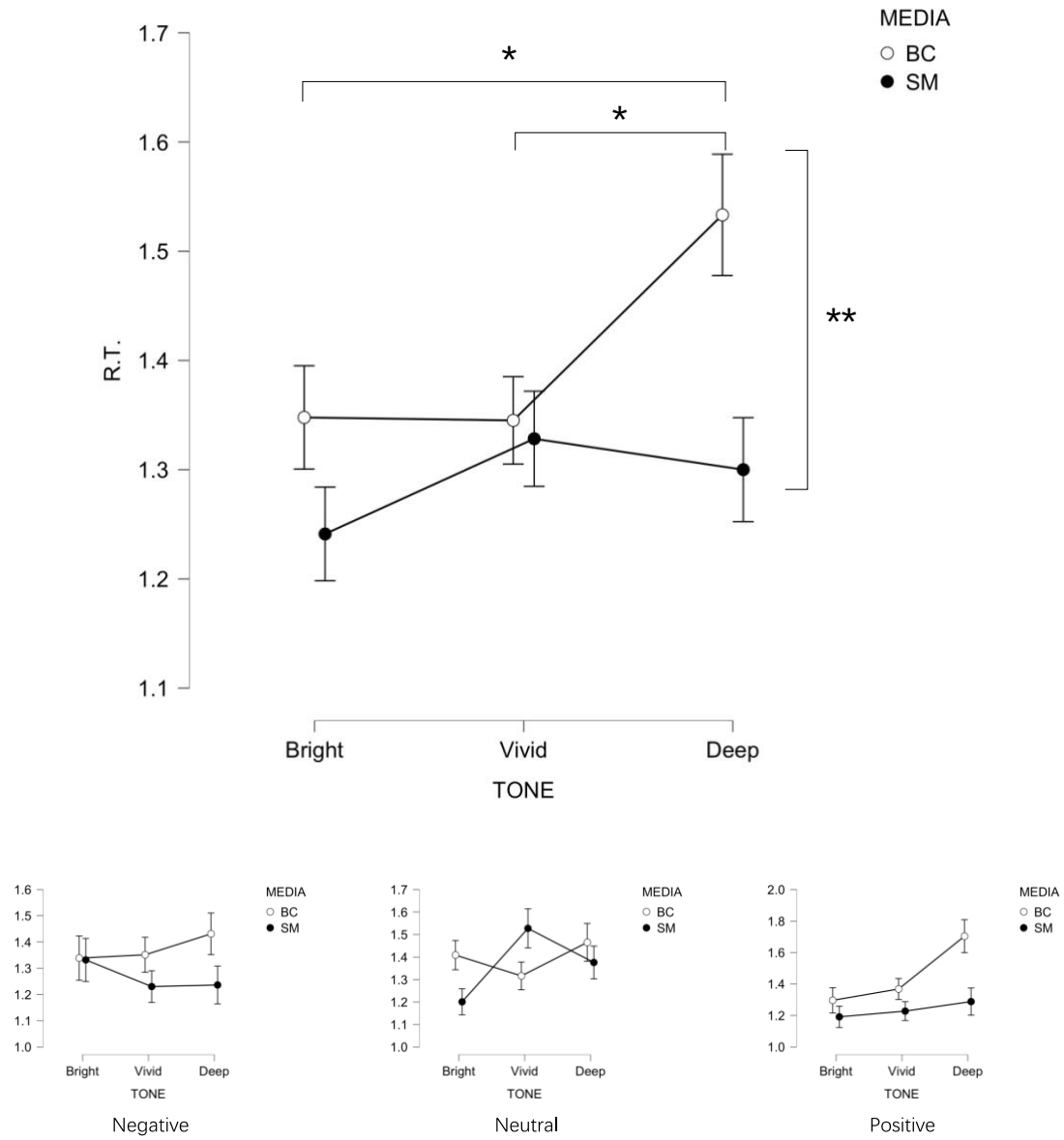
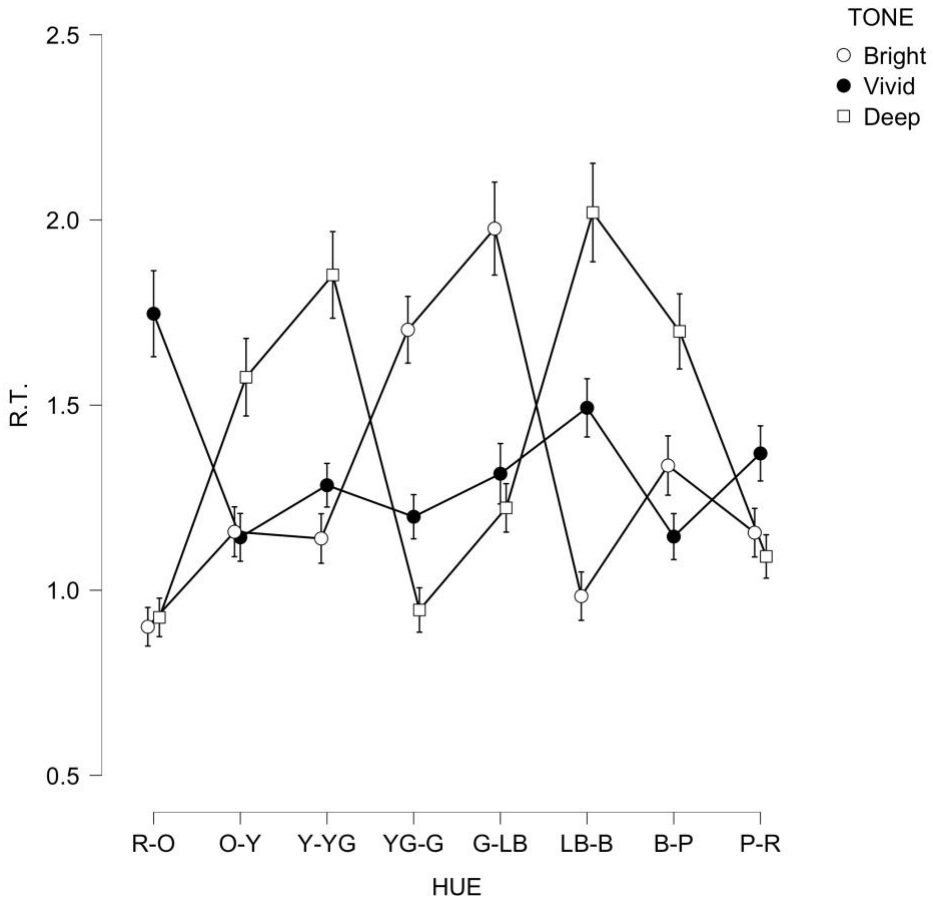


Fig. 71 | The reaction time of two application contexts for understanding the news novelty perception in the emotional contexts

As for the factor of color consisting of hue and tone, some characteristics can be grasped according to the reaction time corresponding to the scene selection rate (Fig. 72), which can further illustrate the influence of OCT color in the deciding process. In general, it can be roughly grouped into three categories. The first category is the reaction time at around 1 second, which can be regarded as easier to judge, e.g., the R-

O group of bright tone and deep tone, the YG-G group by deep tone, and the BG-B group by bright tone. The second category is the reaction time within 1.5 seconds, which can be regarded as a medium-speed reaction, mainly including but not limited to the groups of vivid tone. The reaction time of the third category is more than 1.5 seconds, which can be regarded as the reaction with a more difficult decision, and this category involves all tones with differences between each hue group, e.g., the decision time of news scene novelty of G-BG group and the adjacent BG-B group was also more than two seconds, but the G-BG group was the case under bright tone, while the BG-B group was the case under deep tone. Referring to the selection rate in the following table, it can be found that in case of the bright tone, after lengthy consideration, although the novelty of the scene containing the intermediate color OCT was better, the novelty of green condition cannot be ignored. In the deep tone, the BG color and the blue show a 40% versus 60% situation, and some participants feedbacked that this was due to the similarity of the visibility in terms of their hues; thus, it was difficult to decide, but this was limited to the deep tone. It reveals that the reaction time can reflect the thinking state of the participants when judging the news novelty. The 50% of the deep tone color pair need time to be decided more than 1.5 seconds, which also implies that the deep tone color OCT is more inappropriate in the realization of news novelty. Besides, the R-O group with a decision time longer than 1.5 seconds in the vivid tone condition significantly differed from the other hue groups, which indicates the common role of hue and tone in news novelty perception.



(The selection rate for conference)

S.R. (%)	R-O		O-Y		Y-YG		YG-G		G-BG		BG-B		B-P		P-R	
Bright	0	100	98.7	1.3	13.3	86.7	65.3	34.7	13.3	86.7	99	1	10	90	92	8
Vivid	22.5	77.5	99	1	12	88	93.3	6.7	20	80	53.3	46.7	2.7	97.3	46	54
Deep	99	1	64.7	35.3	66	34	1	99	96.7	3.3	38	62	19.3	80.7	1	99

Fig. 72 | The reaction time for choosing the appropriate hue within one color pair, corresponding to the tone variations. The Table is as a confer information to further judging process.

5.3.3 | The results of the news timeliness dimension

Before the formal analysis, the conditions shown by the table form that were arranged in the experiment are listed again to ease reading. According to the experimental procedure, the three tones (bright, vivid, deep) and three time-nodes (1 minute, 1 hour, 1 day) were matched into nine specific conditions corresponding to three groups of participants, i.e., 301, 302, and 303, where the 3 represents the experiment number of this session, and the 01, 02, and 03 represent the specific experimental group numbers, respectively.

Group	1m	1h	1d
301	Bright	Vivid	Deep
302	Vivid	Deep	Bright
303	Deep	Bright	Vivid

(The condition table)

This session of the experiment was designed to explore the perceptions of news timeliness through a memory test in the news context with the color OCT. Specifically, the images stimuli in the memory test were used to measure the correct response rate and the corresponding response time in the specific conditions. From the results of previous experiments (see Chapter 4), the perception of news timeliness evaluation was influenced by changes in the OCT hue and tone as well as the emotional context. However, in this experiment, the results of perceptions of news timeliness in the BC condition and the SM condition nearly overlapped, i.e., the news timeliness was not significantly affected by the application context, which implies that the perception of news timeliness was more stable. But, within each application context, the results revealed the participants' psychological tendency to judge the news timeliness.

The correct response rate abbreviated as C.R. and response time abbreviated as R.T.

are as indicators employed to further presentation. As shown by the blue line in Fig. 73, the C.R. results between the three groups, i.e., the three conditions, were approximately about 80% for Group 301, about 35% for Group 302, and around 25% for Group 303, respectively, with significant differences observed between them (F [2, 429] = 184.564, p < .001). The comparison shows that the C.R. of the Group 301 was significantly higher than the other two groups, i.e., Group 302 (t = 15.158, p < .001), and Group 303 (t = 17.803, p < .001). Also, the C.R. of Group 302 was significantly higher than Group 303 (t = 2.645, p = .023), which suggests that the manipulation of the OCT tone can affect the perception of news timeliness. Accordingly, by measuring the R.T., as shown by the gray line in Fig. 73, the corresponding R.T. between the experimental groups were about 2.5 seconds for Group 301, around 3.8 seconds for Group 302, and about 4.4 seconds for Group 303 respectively, and the observed differences between them were significant (F [2, 429] = 225.350, p < .001). The comparison shows that the R.T. of the Group 301 was significantly faster than the other two groups, i.e., Group 302 (t = -14.678, p < .001), and Group 303 (t = -20.622, p < .001). Moreover, the R.T. of Group 302 was significantly faster than the Group 303 (t = -5.945, p < .001). The correlation of the C.R. and R.T. reveals that a negative correlation was observed with a correlation coefficient of - 0.526 and this correlation was significant (n = 432, p < .001), as shown in Fig. 74. In summary, the color-time composition of Group 301 for news timeliness perception was better than Group 302 and Group 303, as well as the composition of Group 302 was better than Group 301.

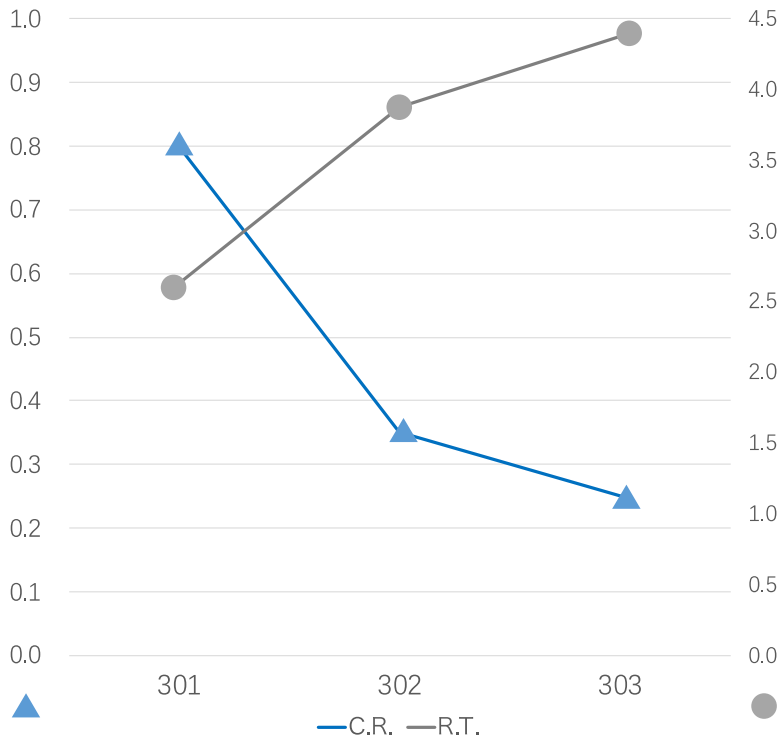


Fig. 73 | The correct response rate and the corresponding response time of the Group 301 (1m-br. / 1h-vi. / 1d-dp), the Group 302 (1m-vi. / 1h-dp / 1d-br.), and the Group 303 (1m-dp / 1h-br. / 1d-vi.) in the memory test for the perception of news timeliness

Pearson's Correlations

			n	Pearson's r		p
C.R.	-	R.T.	432	-0.526	***	< .001

* p < .05, ** p < .01, *** p < .001

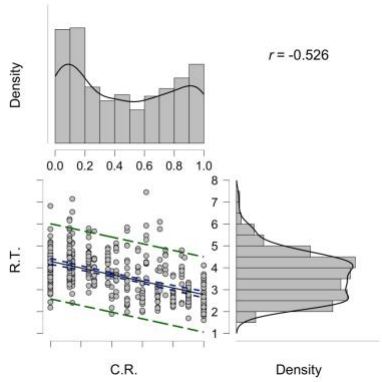


Fig. 74 | The correlation test for the association between the correct response rate and response time

Subsequently, the correspondence between the OCT hue and time-node in the BC and SM conditions was explained as follows. Overall, the C.R. of the two conditions was nearly identical, which reflects the stability of the color-time composition, but also potentially adversely affected by the relatively short interval between the two experimental conditions; therefore, future efforts will be attempted to adjust the interval duration between the two experimental conditions to avoid this potential influence. As shown in Fig. 75, the overall C.R. of the three processing levels, i.e., the 1d-br., 1d-vi., and 1m-dp, was at a low level in both news application contexts, below 30% overall, and even below 20% for the first two, i.e., participants considered that it is difficult to correspond such color-time conditions, which implies that the OCT by bright tone can barely accurately represent the news timeliness when news was released 1 day before. The combination of 1 day with the vivid tone and 1 minute with deep tone, made it difficult to accurately convey the news timeliness.

The average of the C.R. was slightly higher in the SM condition than in the BC condition in both news application contexts, but no significant difference was observed. The three levels, i.e., the C.R. of the 1h-br., and 1h-dp, and 1m-vi. remained at the

medium standard, i.e., about 50% overall, compared to about 40% around the first two levels. In other words, at most close to half of the participants can correctly recall the correspondence of the color-time conditions, which indicates that the bright tone OCT can keep the timeliness of the news released before 1h. It is worth noting that the OCT by deep-toned hue can convey to certain timeliness of the news released 1h ago. Similarly, OCT by vivid-toned hue can convey to some extent that the news was released 1 minute ago.

The C.R. for the three processed levels, i.e., the 1d-dp, 1h-vi., and 1m-br. in both news application contexts was high overall, averaging over 70%, even such as the 1d-dp level in the SM condition, approaching 90%, and all three levels belong to the Group 301. It implies that the OCT colors presented in this way can accurately achieve the news timeliness. Based on the above negative correlation between the C.R. and R.T. mentioned, the recall response time for each of the above levels shows a contrasting trend as shown in Fig. 76, i.e., the levels with the lower C.R. took the longer R.T. and vice versa. It shows that the OCT by bright-toned hue was suitable for news released 1 minute ago and has the possibility of being suitable for the news released 1 hour ago, but not for the visual presentation of news released 1 day ago. The OCT by deep-toned hue was suitable for news released 1 day ago, and can be possibly suitable for news released 1 hour ago, but not for the visual presentation of news released 1 minute ago. It is worth noting that for the perception of news timeliness of news released 1 hour ago, there was a certain degree of likelihood that the effects of the bright-toned hue were similar to the deep-toned hue, which reveals that all the three tones have the possibility of being suitable for the presentation of the news released before 1 hour.

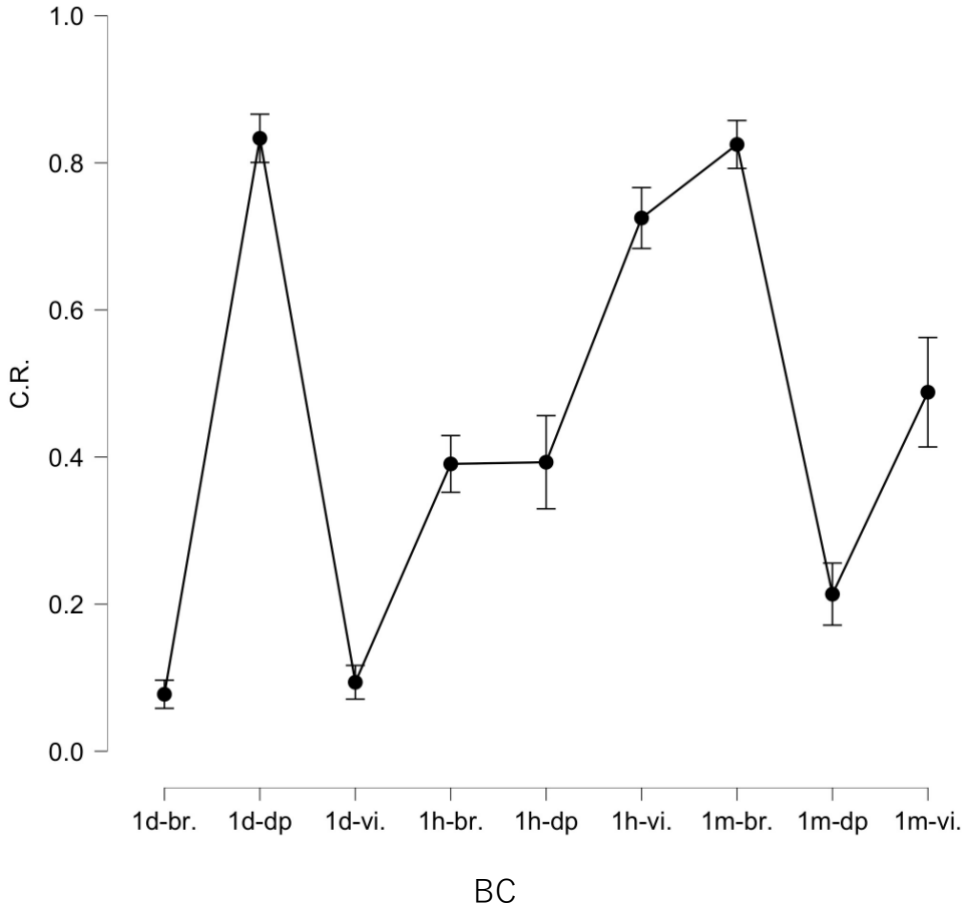


Fig. 75-1 | The correct response rate of the nine levels color-time conditions for the perception of news timeliness in the BC context

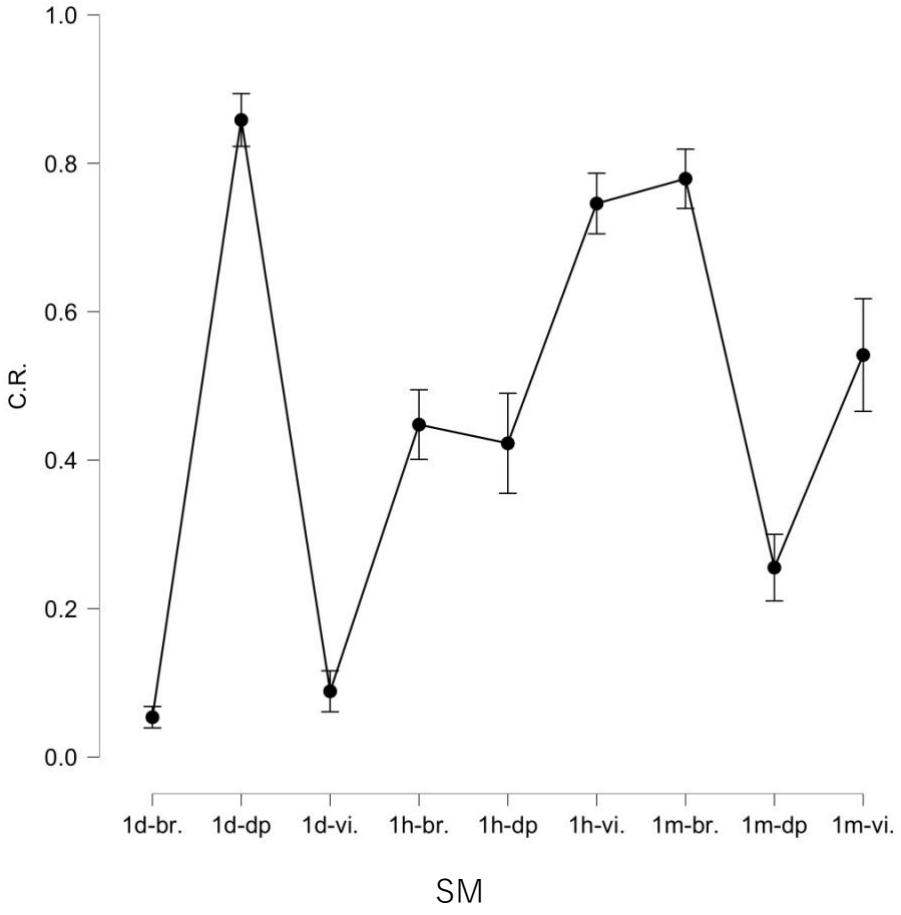


Fig. 75-2 | The correct response rate of the nine levels color-time conditions for the perception of news timeliness in the SM context

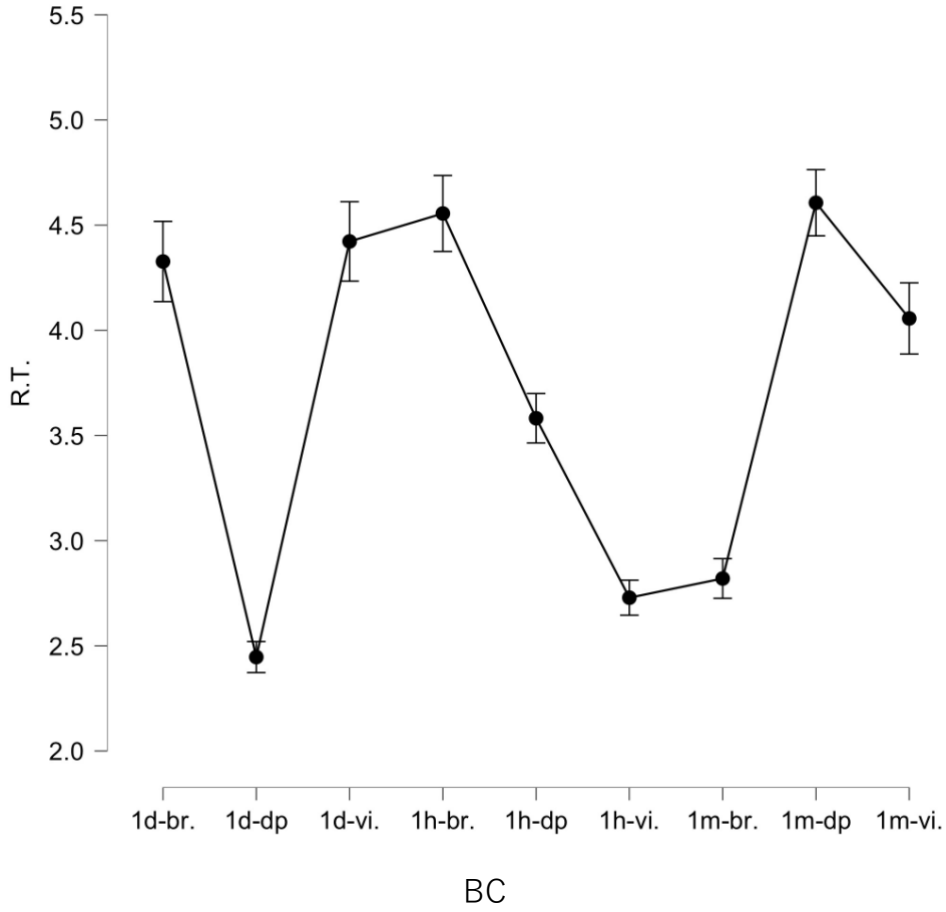


Fig. 76-1 | The reaction time of the nine levels color-time conditions for the perception of news timeliness in the BC context

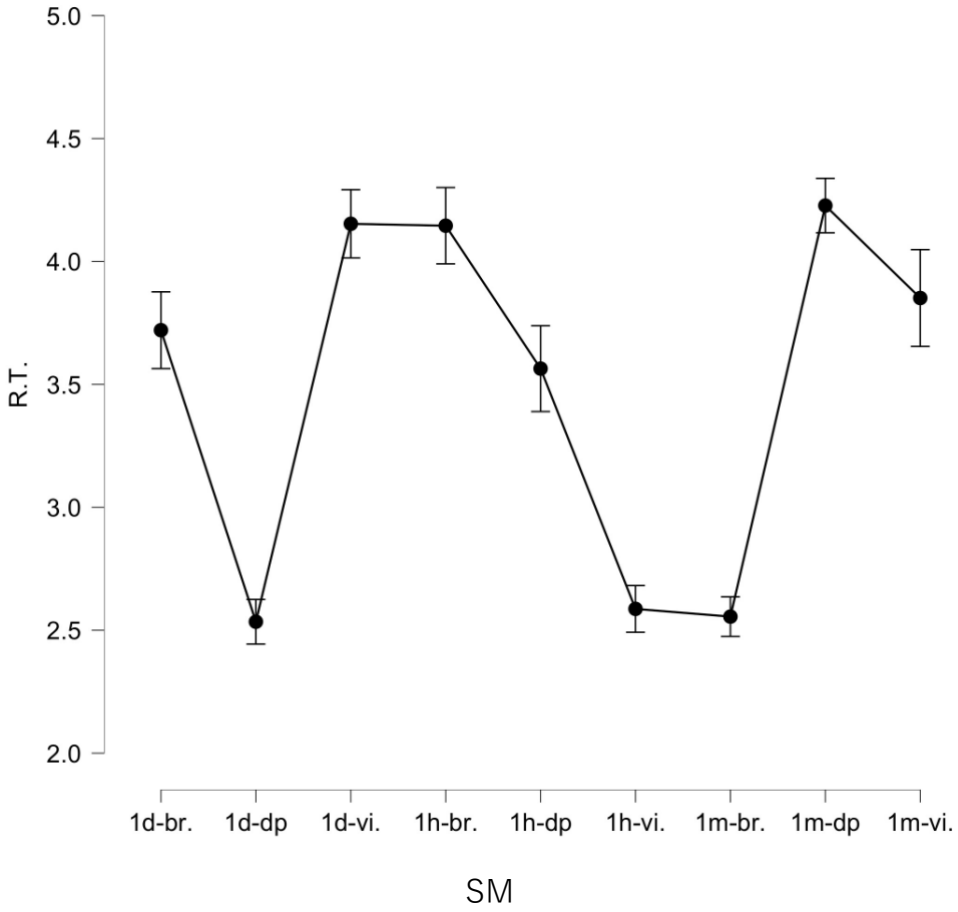


Fig. 76-2 | The reaction time of the nine levels color-time conditions for the perception of news timeliness in the SM context

From the hue perspective, as shown in Fig. 77, there was a relatively diverse performance regarding the differences in the news timeliness perception within and between experimental groups, which was further sorted out as follows. Significant differences were observed for the interaction between condition group and hue (F [14, 384] = 3.172, p < .001). In general, participants in the three groups performed more consistently in the BC condition and SM condition, i.e., Group 301 has the highest C.R. corresponding to each color-time condition, followed by Group 302, and Group 303 was relatively lower. Specifically, in the BC condition, Group 301 has the highest C.R. for purple, green, YG, and blue, which can be regarded as the same level. The remaining four colors were the next highest. In the SM condition, Group 301 has relatively higher

C.R. for purple, YG, green, blue, and BG colors, and the remaining three colors followed.

According to the ANOVA results, within Group 301, differences in the C.R. between the hues were not significant. In other words, the perceived news timeliness in this condition was more stable for all OCT color hues. Group 302 was observed to have a larger mean difference, i.e., below 20% or over 60%, within the two application contexts, respectively. The C.R. ranking was higher for red, green, and orange, respectively, and the BG color was the lowest, even lower than the BG color in Group 303, with minor differences in the ranking of the remaining color hues between the two contexts. In this group, there were significant differences in the C.R. between the top-ranked red (t = -5.25, p < .001) and green (t = 4.407, p = .003) color hues and the bottom-ranked BG color, respectively. Mean differences were observed between hues in both application contexts in Group 303, respectively. But no significant difference was observed. Generally, the C.R. was at the lower end of the three groups. The C.R. for red and blue was slightly better than the other hues, which reflects the relative stability of the primary hues.

Besides, about the hue, differences between groups were very obvious. The most significant differences were concentrated in Group 301 to the other two groups. Specifically, in both application contexts, the C.R. was significantly higher in Group 301 than in Group 303 (t = 3.790, p = .033), and at the same level as Group 302 in the red OCT condition. The orange OCT condition was similar to the red, i.e., the C.R. in Group 301 was significantly higher than that in the Group 303 (t = 6.334, p < .001) and was at the same level as the Group 302. In the yellow OCT condition, the C.R. of Group 301 was significantly higher than that of Group 302 (t = 5.072, p <.001) and Group 303 (t = 5.776, p <.001), respectively.

The YG color OCT condition, the C.R. of Group 301 was significantly higher than that of Group 302 (t = 7.361, p <.001) and Group 303 (t = 7.466, p <.001), respectively. In the green OCT condition, the C.R. was significantly higher in Group 301 than in Group 302 (t = 4.716, p <.001) and Group 303 (t = 8.057, p <.001), respectively. In the BG color OCT condition, the C.R. was significantly higher in Group 301 than in Group 302 (t = 7.679, p <.001) and Group 303 (t = 6.449, p <.001), respectively. In the blue

OCT condition, the C.R. was significantly higher in Group 301 than in Group 302 (t = 6.657, p <.001) and Group 303 (t = 6.235, p <.001), respectively. In the purple OCT condition, the C.R. was significantly higher in Group 301 than in Group 302 (t = 7.537, p <.001) and Group 303 (t = 7.515, p <.001), respectively.

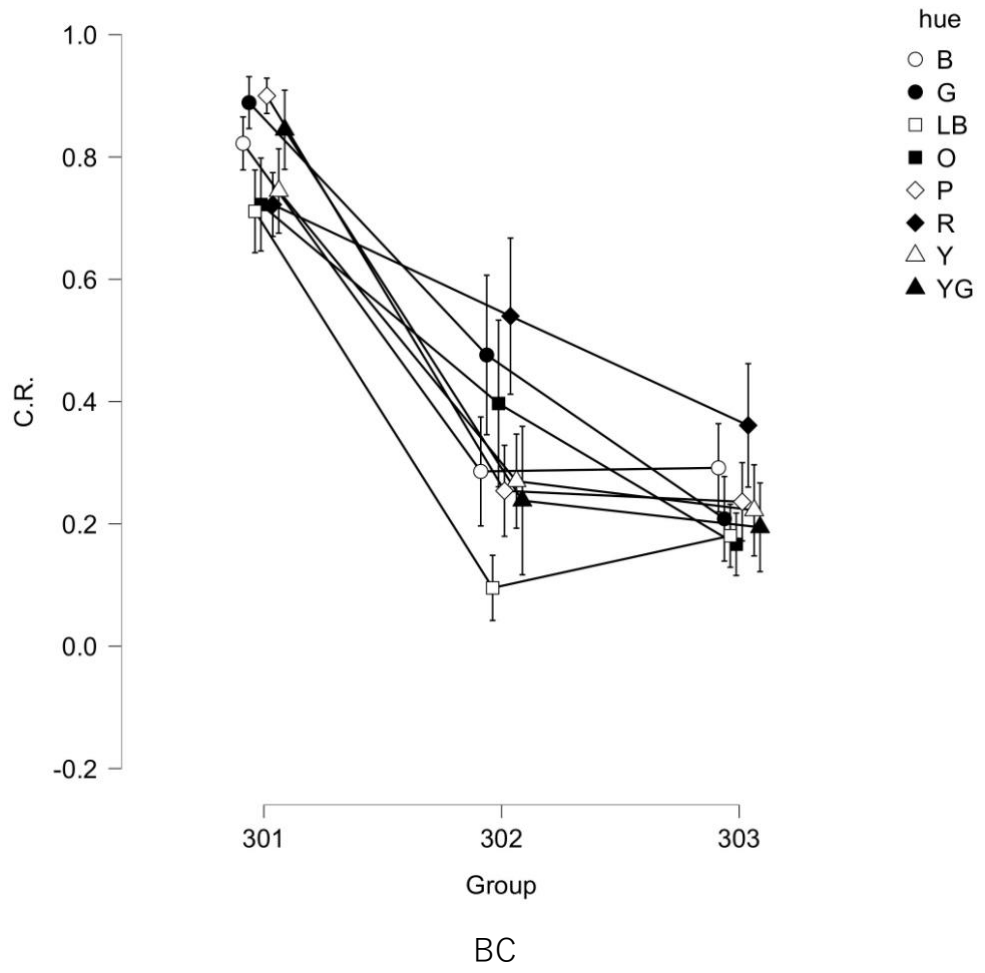


Fig. 77-1 | The correct response rate of the three groups for the news timeliness perception from the hue perspective in the BC context

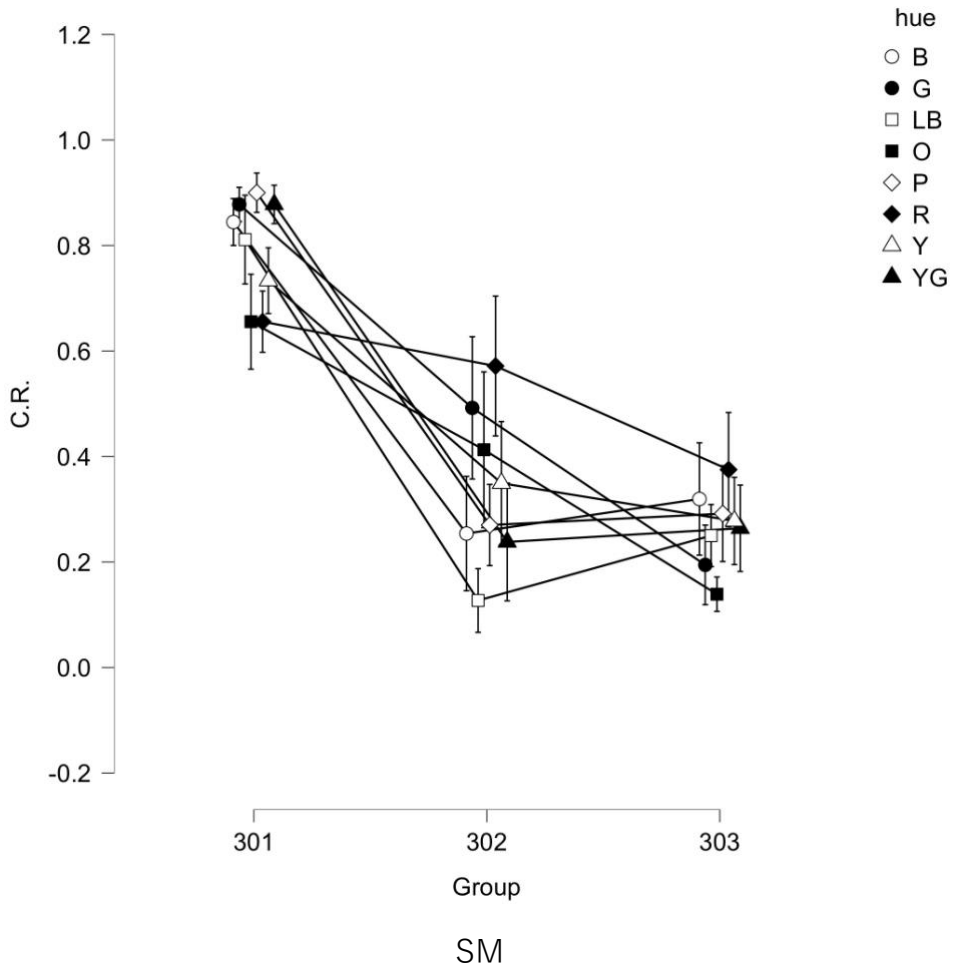


Fig. 77-2 | The correct response rate of the three groups for the news timeliness perception from the hue perspective in the SM context

Moreover, in the news emotional context, as shown in Fig. 78, the C.R. of the negative context was better than the other two emotional contexts in both application scenes, with the mean value of all three not exceeding 50%. It is worth noting that in the neutral context, the mean C.R. for the BC condition was lower than that of the SM condition, and was at the lowest of all conditions, but it does not involve a significant difference. This implies that the neutral emotion may not easily form collinearity with other conditions resulting in a low correct response rate. The C.R. was slightly lower in the positive context than in the negative context, which again validates the news value theory that bad news was stronger than good news. No significant differences

were observed between the two application contexts by the ANOVA, suggesting that the emotion of news does not have a direct impact on the perceived news timeliness in these contexts, but its potential indirect impact cannot be excluded through this experiment.

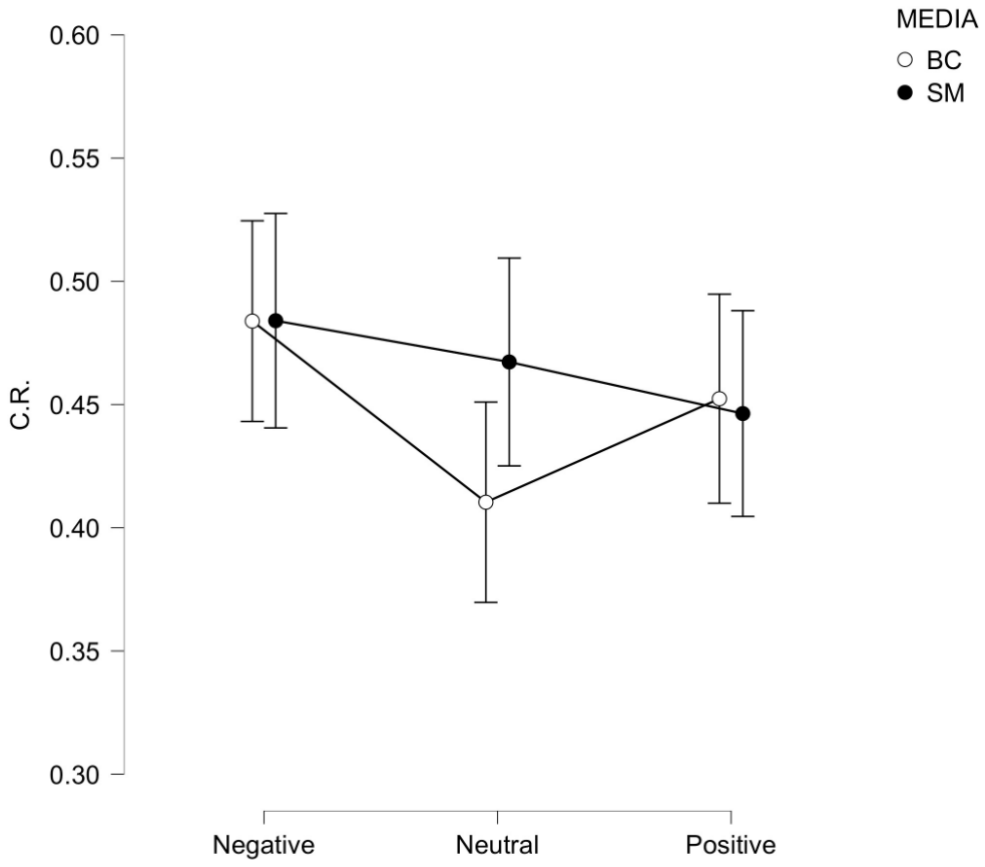


Fig. 78 | The correct response rate of the two application contexts in the three news emotional contexts

5.4 | Discussion

Through the simulation the actual news transmission and the way the participants experienced it, the perceptions of news value in the application context can be captured

to some extents. According to the results, there was indeed a difference between the two application contexts in the experimental conditions (see the importance dimension). In the usual sense, social media (i.e., the smartphone in this case) are easy to carry around and can be used to watch the news anytime, anywhere, and are very timely, whereas broadcast style (i.e., the TV in this case) cannot be carried around and is watched at home. The size of the screen is different between the two media; thus, the size of the text and the color area are different. Relatively, social media are not suitable for the elderly. But whether such a difference was significant enough is a question that needs further demonstration. Nonetheless, the consistency exhibited in the two contexts in the experiment was sufficient to demonstrate the stability of color OCT in different usage contexts (see the novelty and timeliness dimensions).

Regarding the specific performance of color in the application context, the overall results were essentially not too different from the general direction of the previous experiments, but also yielded some differences. For example, in the dimension of news importance, the response to the OCT tone was no longer the most important by a darker tone, and the results indicate that the brighter tone of the OCT may also make the news perceived more important. Both of these results are reasonable due to the difference between the two experimental methods and the experimental conditions. In this section, participants responded to the stimulus images through behavioral responses, which was designed to capture the effects of OCT color on the perception of news value from objective perspective. The SD method used in previous experiments focuses more on the OCT color itself.

Secondly, in the dimension of news novelty, the brighter tone of intermediate hues or even vivid toned hues are more appropriate for the expression of news novelty in the various emotional contexts. In contrast, the combination of primary hues and darker tone has a similar effect, but it was generally less expressive than intermediate hues, which suggests that the hue should take precedence over tone.

Finally, in the dimension of news timeliness, the experiment held the following guesses at that time, such as whether a color OCT by the vivid tone would make the news most current, by the bright tone second and the deep tone the worst. Certainly,

this was only a speculation at that time. According to the data, there was a big difference on this speculation, and the results are also very different from the previous experiments. Specifically, the bright tone OCT scenes show the greatest news timeliness, followed by the vivid tone, and the deep tone that was similar to what was expected. The saturation of all colors was within the same category, i.e., the high-level saturation, the 9s for the vivid tone, and the 8s for the other two tones. However, there was a huge difference in the lightness of the three group colors. The hues with the deep tone belong to the low lightness color, i.e., the lightness is 3.5. The hues with the vivid tone belong to the medium lightness color, i.e., the lightness is 5.5. The hues with bright tone belong to the high lightness color, i.e., the lightness is 7.5. Therefore, the lightness deserves to be taken more into account than the saturation in the tone. Besides, it was also observed in previous experiments that the deep-toned OCT may contribute to perform the news timeliness, i.e., some deep-toned colors, such as the deep-toned red, deep-toned green, and deep-toned purple, also have an undeniable role in promoting news timeliness. Regarding this situation, the author continues to believe that it is closely related to the difference in experimental conditions and the difference in measurement methods.

In summary, the behavior of the participants in the experiment suggests that the color manipulation of OCT in the given application context is stable in terms of perceived news value, i.e., the application context does not make color OCT inappropriate due to changes in the context of use. Likewise, this suggests that the effect of OCT color manipulation is almost consistent across application contexts.

CHAPTER 6

| GENERAL DISCUSSION AND CONCLUSION

6.1 | About the theme

The theme of this research is to explore the effects of OCT color processing on the perception of news value in specific emotional and media contexts. Some relevant studies have shown that different colors of OCT in soft content can manipulate viewers' cognitive evaluations to the program and may influence their subsequent behavior. However, as mentioned above, relevant studies on OCT exist, mostly in tabloid or entertainment scenes other than news; therefore, this research attempts to conduct the study of news from the OCT application in the contexts. So far, this research has generally covered the effects of OCT color on the perception of news value. As for the audience's post-viewing behavior and whether it involves public opinion manipulation or even more profound communication effects, this research has not yet been involved.

Regarding the mechanism of color OCT, based on the experimental results, this research considers that it mainly involves the physical characteristics of color; e.g., red has attention-arousing effects; the association between color and emotion that has been confirmed by relevant studies, e.g., the association between high brightness and positive emotion; and the blending and contrasting relationship between OCT color and the background color of the news content. In addition, other possible action mechanisms are still being explored.

Concerning the understanding of news value, it should be emphasized that this research was focused on psychology; therefore, the news value identified herein is another level of news value, i.e., editors do a secondary process on news that has already been selected rather than selecting the news. News value in journalism is the process of finding news content with reporting value through journalistic sensitivity, i.e., selectivity, while news value in this research is the secondary processing of news reports and content without distinction, aiming to emphasize the value achievement of news itself, which is applicable to all kinds of news.

6.2 | The generalization of research methods

In Chapter 2, Chapter 3, and Chapter 4, the SD method was used, which is one of the subjective methods for cognitive evaluation commonly used in journalism and psychology. The SD method can properly help participants to reach their understanding and judgment of news value. In Chapter 5, the reaction time and correct response rate were measured, which is more commonly used in psychology research. The media application context was given to form a more complete visual news presentation, and the SD method alone cannot fully measure the participants' behavior in the simulation experiment; thus, the introduction of more objective measures, i.e., the reaction time and correct response rate is necessary. Meanwhile, such a methodology arrangement can progressively facilitate the author's understanding and comprehension of psychological research methods. Certainly, the author is still in the stage of practicing and further exploring the research methods of psychology. It is important to declare that although the psychological experimental research method was used in this research, the psychological interview was not adequately covered for various reasons, and this may be a shortcoming that needs more consideration in the future.

Regarding the analysis method, combined with the purpose of the research, the analysis of variance (ANOVA) and the correlation test were mainly used. The former is responsible for testing the significance of the quantitative differences between conditions in the experimental groups and control group, as a way of putting under examination the experimental hypotheses postulated by the corresponding experiments. In this research, the repeated-measures ANOVA was mainly conducted, and only in session three of Chapter 5, the between-subjects ANOVA or as it can also be referred the mixed factors in a non-strict sense was conducted for the perception of the news timeliness. The purpose of using the correlation test is to investigate whether the OCT color can integrate multiple news dimensions to achieve the realization of news value. According to the results of this study, this analysis method also helps to complete the

research. In addition, in future studies, trying to use the analysis method of nonparametric test will be expected to understand this research more comprehensively.

6.3 | About the results

In this research, the experiments consist of three major parts, including OCT patterns alone (Chapter 2), the incorporation of the emotional context (Chapter 3 & 4), and the incorporation of the application context (Chapter 5), each of which corresponds to more specific sessions depending on the dimensions of the news value of the test.

According to the results of all experiments, the different stages indicate a general consistency and the individual differences. For Experiment 1 (Chapter 2), only the OCT pattern was used to examine the latent possibility of color by evaluating the news value. This stage does not involve journalistic elements other than the news value conception. The results reveal that the participants had their own perceptions of the importance, novelty, and timeliness of the potential news when the OCT was processed by color including the hue and tone. The distributions observed in Fig. 8 – Fig. 10, which represents the individual cognitive differences, show that most of the participants performed essentially the same cognitive trends, except for the unique perceptions exhibited by a very few participants. Furthermore, the results of the ANOVA for Experiment 1 indicate that color is sensitive to the projected perception of news value. In other words, it is necessary to clarify that color is likely to have the same effects on viewers' perception of content in the field of news as it does in entertainment programs.

Regarding Experiment 2, it is the main part of this research. Although it is not the final form of this theme, it has the role of carrying forward and starting the next. Experiment 2 was divided into two parts in the operation stage, i.e., the hue aspect (Chapter 3) and the tone aspect (Chapter 4), while the news emotional context was shared by both aspects. Meanwhile, in this section, the question of whether color can

integrate the news value dimension through the emotional context was also adequately discussed. Therefore, the results can be applied to a broader range of news content. At the same time, a preliminary proposal for the selection of OCT colors in specific news contexts was also presented.

Concerning Experiment 3, the issue was further clarified in the application context. The application context is the media format that commonly can be regarded as the end form for news dissemination. This study discusses the extent to which news value was achieved in different media representations, i.e., the television broadcasting and the social media, respectively. Specifically, the differences are shown in the news importance dimension across application contexts, which shows that judgments about the importance of news in different application contexts can be influenced by the color of OCT. For example, in the BC context, the news with the three toned BG color OCT keeps approximately the same retention time, while it is more dispersed in the SM context. The color of the OCT has an impact on the retention time of the news scenes, i.e., the news importance, in different application contexts. Therefore, in journalistic practice, it is necessary to assign the appropriate colors to the specific scenes in conjunction with different application contexts. Through the experiment, the hues such as yellow that is not suitable for achieving news importance can be filtered out. Because it is constrained by multiple factors, e.g., the brightness is too high resulting in not being easily visible; thus, it will be very difficult to use alone in any application context. Considering that, the use of such hues and the matching of tones needs to be further clarified in the situations that involve non-monochromatic hue. Concerning the cognitive performance of participants after OCT tone manipulation in the application contexts, there is more general agreement that the vivid tone can highlight the importance of news, i.e., the average time that was spent in news scenes containing vivid tone OCT is longer, with the exception of green. This is mainly considered that most cases where green is used in real life focus on the association with relaxation, calmness, and other imagery, rather than colors like red and blue that are clearly used to suggest danger or evoke important things, especially the bright toned green is more inclined to relief performance; thus, it may cause a counter-effect in perception of news

importance. In summary, it is necessary to use OCT colors appropriately according to the application context.

News novelty and news timeliness received relatively less influence from the application context than the news importance dimension. According to the final results, the overall cognitive responses differed less between the two application contexts, i.e., no significant differences were observed, which reveal that the participants' perceptions of news novelty and timeliness are quite consistent and stable in near-actual application contexts. Also, the solution plan of news novelty was also refined in this section. One of the most obvious features of the solution plan is that the role of multiple intermediate hues dominated by orange was recognized and the primary hues are able to achieve news novelty in the deep tone across the application and emotion contexts.

Regarding the perception of news timeliness, the cognitive performance between the BC and SM contexts is relatively consistent, which reflects the contextual stability of this dimension. However, cognitive performance within contexts was observed to be very significantly different across groups of conditions and across levels. The group consisting of the shorter time node (high timeliness) with the bright-colored OCT had a significantly superior memory correct response rate than the other tonal manipulation groups. The group that consists of the medium-length time node (general timeliness) with the vivid tone OCT had a significantly greater memory correct response rate than the other tone groups. The group consisting of the longer time nodes (low timeliness) with the deep color OCT had a significantly greater memory correct response rate than the other tone groups. It can be seen that in the high timeliness condition, participants preferred the bright tone, followed by the vivid tone and, most rarely, the deep tone. However, it had been predicted that the high-time-node may preferentially correspond to vivid tone. In the general timeliness condition, participants preferred the vivid tone, followed by the deep tone or bright tone, with little difference between them. Although it was considered that general timeliness might be preferred to the bright tone. In the low timeliness condition, participants preferred the deep tone, followed by the vivid tone or bright tone, with no significant difference between the them, which is generally consistent with the speculation. The three experiments step by step examined the role

of color OCT on the perception of news value in the semi-actual situation.[11]

6.4 | The prospects for this research

Although this research is relatively complete in examining the issue of color and news value, there is still room for improvement. For example, questionnaires and more systematic personal interviews can be applied to reflect the full landscape of the experiment and to provide a more focused interpretation of the results. Moreover, a more diversified analysis method can be tried in the research, i.e., the analysis method of non-parametric testing, which can be combined with the analysis method of parametric testing. Furthermore, at this stage, only a monochrome OCT with moderate style was employed; thus, it is difficult to estimate the potential influence of the design and color settings of the OCT pattern. Whether the number of images associated with news emotional contexts is relatively small, it also needs to be demonstrated in future studies or the use of other approaches.

The section on participant description also has the following points that need to be improved. Japanese and Chinese subjects were involved in this study, but their nationalities were not explicitly indicated. This was mainly considered because this study was not a cross-cultural comparison study for the time being, and the ANOVA results of gender and nationality as covariates showed that no significant differences were detected between the two countries' subjects. Certainly, elements such as gender and nationality will be given much attention in the future according to the research needs.

Regarding future research, the author has a few prospects. Initially, within the scope of color research, to further clarify the association between OCT design, color scheme and the perception of news value. Then, based on the present stage of the simulated application context, the author will gradually try to transfer to real application

contexts. Thus, the viewers' judgment of news value can be more accurately captured. Ultimately, the author aims to propose a standard color scheme solution that can be practically used in news OCT systems based on news emotional contexts and application context with the goal of realizing news value.

6.5 | The general conclusion

This thesis is an interdisciplinary research study of psychology and journalism. The research has concerned with revealing the psychological significance of color in the process of achieving news value as a goal. The research demonstrated that color OCT has different effects on the realization of news value in the specific context through a series of experiments, and it also clarified the significance of color in journalistic practice.

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In Japan

2021

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Chapter 4

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