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写真家アーヴィング・ペンの深奥質感なテクスチャ表現の研究

Irving Penn ’ s eye-catching texture expression in photography

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概要: VR において，人間が有する抗いようのない情動に訴えかけるような質感表現は，どのようなものであろうか．そのヒントを得るために，20 世紀を代表する写真家アーヴィング・ペンの作品を取り上げ，写真に写る被写体と写真自体の形状・色彩・触感などが人間にもたらす質感の認知および行動変容に関する研究を実施した．ペン氏の代表的な写真作品を模倣した習作を行い，ペン氏の写真には 1. 照明技法 2. 被写体の立体的構造 が重要であると考察した．またペン氏の写真と併置して感性実験を実施し，多変量解析を実施した結果，ペン氏の写真には a. 心地よくチャーミングであり触りたいと思わせる b. 目を引くような要素 を表す 2 つの因子が抽出された．加えてペン氏の写真を評価するのに相応しい感性評価ワードを 24 語選定した．

キーワード： VR 芸術，視覚表現，感性評価，深奥質感

1. Introduction

Advancements in computer graphic (CG) technology have led to an increasing realism in virtual humans and objects, blurring the distinction between the virtual and the real. Saya designed by TELYUKA, and Miquela designed by Brud are a few examples of early virtual human models. Additionally, research by Shingo Tokai [1] and Henrik W. Jensen [2] showcases how CG technology can create realistic objects and environments. Furthermore, CG technology allows for the creation of unique sculptures and self-generative animations that go beyond what is possible in the real world. Yoichiro Kawaguchi and his team have used a method called THE GROWTH MODEL to create self-generative CG animations since the 1970s [3, 4]. These are very few examples of how art expressions are carried on to the virtual reality (VR) context. However, there is limited scientific examination of the aesthetics of these artworks and their impact on human perception. A team from Kansai University aims to research the aesthetics of human skin texture, modeling CG-made human skin and then evaluating the relationship between impressions and physical properties of the real and generated skin texture [5]. Nevertheless, these are not in the context of reckoning art expressions. To bridge this gap, this study seeks to deepen our understanding of art expression by analyzing still-life images shot by photographer Irving Penn while referring research method by Tobitani et al. (2017) [5]. Through imitation and multivariate analysis of adjectives, we seek to uncover a qualitative understanding of Penn’s artistic expression through quantitative data.

2. Study 1: Study by imitation

The purpose of the study was to delve into Irving Penn’s photographic techniques. By replicating his photographs, the researchers aimed to gain an understanding of the challenges, nuances, and creative decision-making involved in producing such memorable images.

2.1 Material and Method

2.1.1 Procedures

3 photographs used for the imitation study (Frozen Foods with String Beans (1977) [6], Cracked Egg (1958) [6], Poached Eggs and Salts of the Earth (2001) [7]) were imitated twice over 2 months through August to October in 2022. Photographs were taken after sunset to avoid unwanted natural light leakage. The imitation is photographed using Sony Alpha 7 iii.

2.2 Results

The result of the imitation practice is shown in Figure1. This imitation study was conducted with careful observation of the original photographs. There are 2 points learned in this imitation study.

2.2.1 The Lighting Techniques

Penn's lighting technique plays a crucial role in highlighting intricate textures. Skillfully captured in a subtle, yet upon closer inspection, they reveal their vital significance in Penn's artistic expression. As a photographer, Penn adeptly controls the frame, guiding the viewers' gaze toward textures through effective light manipulation and enhanced contrast. His still-life images also adhere to the principles of Gestalt psychology, naturally directing human perception through the image as intended. These textures possess a powerful communicative quality, representing the most distinctive and essential characteristic of Irving Penn's still-life photography.

2.2.2 The Structure

Penn's photography showcases gravity-defying structures, exemplified in the imitated image "Frozen Food with String Beans" shot for Vogue. Recreating a stack of frozen food poses challenges, with cubes slipping off in the initial attempt. A supporting structure was added in the background for the second attempt to stabilize the sculpture. In his book "A Note Book at Random", he explains how the image "Collapse" shot in 1980 had a more complex structure. Such intricate structures are recurring in his works, and he effortlessly presents them as if obeying the law of gravity. Despite the off-putting sculptures, viewers often overlook this, creating an unintentional, and perhaps intentional, sense of suspense.

3. Study 2: Sensory evaluation study

The objective of Study 2 is to explore our emotional perception and interpretation of Irving Penn's photographs by analyzing adjectives used to describe the image. The study aims to capture the emotional impact evoked by Penn's photography. A total of 25 photographs including 19 originals by Penn and 6 imitations were evaluated using a set of 48 adjectives.

Additionally, this study aims to uncover the profound sensory information inherent in the textures portrayed through art. The findings from these studies will pave the way for presenting highly replicated multisensory information, such as textures, in VR environments. This advancement will enable users to experience a VR world with heightened realism, creating a more immersive journey for consumers.

3.1 Method

3.1.1 Preparing the photographs

In this experiment, we prioritized maintaining the diversity of Penn's work in the stimuli while considering the size of the study. We selected all 40 still-life photographs available on the Irving Penn Foundation and categorized

図 1: Imitation Study

them into 3 primary groups: black and white, still life, and flowers. These were further grouped into 7 secondary categories. From each of these groups, 2 to 3 photographs were hand-picked for inclusion in the study. As a result, a final set of 19 images was chosen to represent the diverse range of Penn's work. Additionally, to augment the stimuli set, 6 imitated images were included, resulting in a total of 25 photographs. The careful selection process ensured that the stimuli encompassed the range and depth of Penn's photographic repertoire, incorporating both original works and imitated images.

3.1.2 Preparing adjectives

The process of preparing adjectives for this study began by examining the items used in a previous study conducted by Iga and Nakatani (2022) [8]. Their study included 38 adjectives. However, their list was made to asses moving objects which is not ideal for the current study ' s objectives. Therefore additional words were added to the list, gathered by observing Irving Penn's photography, referring to relevant textbooks, and reviewing other photographs that effectively captured textures. A total of 77 words were added to the initial list, resulting in a list of 115 adjectives. Then adjectives were evaluated, and certain words were eliminated based on criteria such as synonymy, anonymity, and uncommonness. This refinement process led to the final selection of 48 adjectives that were deemed appropriate for the study.

3.2 Participants

Participants were 12 students (7 female and 5 male; mean age, 22.3 years; SD, 1.92 years; age range, 19-25

years) enrolled in Keio University.

3.3 Procedures

Participants were instructed to join a Google Meet call from a quiet and bright-lit room, using their laptops. They were asked to have images on the left side of the screen, and a questionnaire form on the right side of the screen. The questionnaire was made of three parts. Participants were presented with 25 photographs, each of them followed up by 48 adjectives, and were asked to rate the degree of appropriateness using a 5-point Likert scale (1 = Appropriate/適する, 3 = Neither/どちらでもない, 5 = Inappropriate/適さない). Between each part, participants were asked to take a break. Most of the participants took 2 hours to 2.5 hours to complete.

3.4 Results

3.4.1 Factor Analysis

表 1: Factor Analysis (Promax rotation)

Japanese	English	Factor 1	Factor 2
心地よい	Pleasant	0.861	-0.185
粗暴である	Wild and Rough	-0.802	0.340
苦しそうである	Distressed	-0.805	0.235
触りたくなる	Want to touch	0.789	-0.028
上品である	Elegant	0.752	-0.168
かわいらしい	Adorable	0.633	0.344
刺激的な	Stimulating	-0.784	0.928
目に訴えかける	Eye-catching	-0.079	0.858
積極的である	Assertive	-0.172	0.828
興奮した	Excited	0.186	0.750
飽きない	Can't get enough	0.130	0.621
コントラストがある	Contrasting	0.111	0.602
Eigenvalue		6.395	5.503
Contribution Ratio (%)		26.6	22.9
Cumulative Contribution Ratio (%)		26.6	49.6

Item analysis was performed for all 48 words to investigate their characteristics. The analysis revealed a ceiling effect, with two words, 嬉しい (mean + 1SD = 5.03) and 弾力のある (mean + 1SD = 5.02), scoring above 5. This suggests a lack of variability in participants' responses. Item-total correlation demonstrated positive and negative correlations between the item and the total item, the coefficient ranging from rs = 0.001 to 0.890. Items with coefficients falling below 0.19 or exceeding 0.9, the following items were excluded: 意味のある, 慎重である, 重さ軽さ感がある, リラックスする, 攻撃的である, 受動的である, 狭そうである, 感情的である, 違和感のない. Lastly, inter-item correlation revealed item redundancy. Items with a coefficient over 0.8 were flagged red, and between 0.7 and 0.79 was flagged yellow. Then we evaluated each flagged item. The following items were eliminated: 鮮やかである, 興味がある, 見たい, 楽しいそうである, 写真を撮りたくなる, 共有したくなる, 魅力的な, 暗い, 正気である, 完全である, 不気味な, ぼんやりする, 温冷感がある. A total of 24 words were taken out for the next analysis.

The data were analyzed using factor analysis to investigate the structure of Irving Penn's texture expression. The factor loadings were 49.6%, and Table 1 lists each factor's eigenvalues, contribution ratio, and factor loadings. Referring to a previous study [9], a factor loading of 0.60 or more was used as a criterion for selecting items. The Kaiser-Guttman criterion (6 factors), and diagonal squared multiple correlation parallel analysis (2 factors) were used to determine the number of factors, according to the method suggested by Hori (2005) [10]. All cases and criteria were considered, and for this analysis, a 2-factor scale was used. A total of 19 adjectives with low factor loadings were excluded from the scale: 左右対称である, 鮮明な, 光沢のある, 集中してじっと見る, 意外である, 進歩的である, 独り占めをしたい, 湿った, 滑らかである, 理想的である, 冷たそうである, 硬軟感がある. Factor 1 consisted of 6 items. Factor loadings with positive scales included: Pleasant, Want to touch, Elegant, Adorable, and with negative scales were Wild and Rough, and Distressed. Therefore factor 1 was named "Comfortable and charming factors that instigate scene of touch". Factor 2 consisted of 6 items. All factor loadings were positive which are Eye-catching, Assertive, Excited, Can't get enough, and Contrasting. Factor 2 was named "Stimulating, attention-grabbing, and exhilarating factors".

3.4.2 Cluster Analysis

To explore adjectives closely related to each other, we conducted cluster analysis using Ward's method. The criterion for determining the number of clusters was based on the similarity within clusters, differentiation between clusters, and a condition that the cluster should consist of more than three words, following the approach used by Tobitani et al. (2017) [5]. The result and the dendrogram are presented in Figure 2, revealing three distinctive clusters: "Stimulating, attention-grabbing & hardness and coldness factors", "Psychical properties of materials", "Emotions and symmetry".

4. Discussion

Factor analysis revealed two crucial factors influencing the impression of Irving Penn's still-life photography. Item analysis identified 24 significant words for analyzing his photographs. Cluster analysis highlighted the importance of the two factors and physical properties (Glossiness, Smooth, Want to touch, Vivid, Moist) when evaluating an image. Previous studies [5, 11] explored aesthetic perceptions through adjective analysis. In addition to the adjectives, our research included action-instigating words like "Want to touch (触りたくなる)", showing close association with words describing material

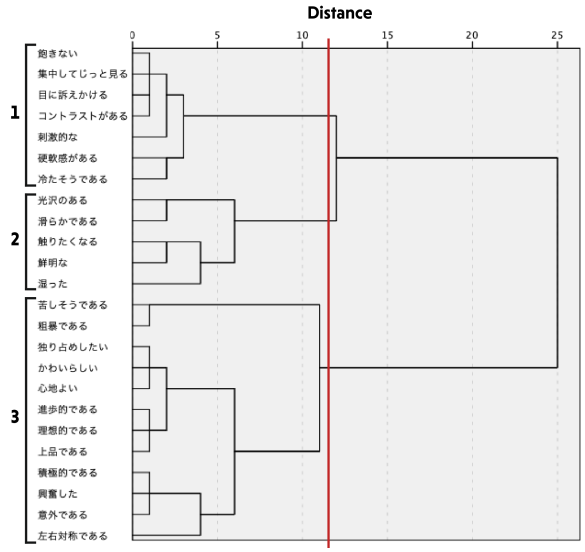

図 2: Cluster Analysis (Ward's Method)

properties. Another study by Teramoto et al. (2010) [12] linked color to a sense of presence (臨場感) in paintings. Interestingly, our study did not find a close association between "brilliant and vivid (鮮明な)" to a factor "Stimulating, attention-grabbing, and exhilarating factors".

Aesthetic psychology emphasizes the importance of balanced weight in a composition. Research by Locher et al. (2005) [13] highlighted the significance of red and yellow in determining the balance. These colors are frequently used by Penn. His photography presents everyday objects from unconventional angles and lighting, proposing a fresh perspective. While studies like Sammartino & Palmer (2021) [14] reveal people prefer familiar angles, Penn challenges this perception by presenting objects in ways that captivate innate preferences and reveal new aspects of the subject through striking lighting. While there is considerable research on aesthetics related to composition, balance, and colors, limited scientific exploration focuses on lighting's impact on texture expression. Enhancing our understanding of intricate lighting texture expressions could improve the immersive quality of virtual reality environments in future investigations. Lighting remains a crucial element in visual art, photography, 3D modeling, movies, animations, and virtual reality experiences. The outcomes of this study will offer valuable insights that contribute to achieving heightened realism and emotional expression within these domains.

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