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The Impact of Gestalt Principles on Mobile Game Preference: An AHP-Based Evaluation

Gestalt İlkelerinin Mobil Oyun Tercihi Üzerindeki Etkisi: AHP Tabanlı Bir Değerlendirme

Abstract

This study explores the role of Gestalt principles in optimizing Cost-Per-Install (CPI) estimation for mobile game advertising. Focusing on continuity, closure, and proximity, alongside sub-criteria such as color variation, geometric arrangement, and text layout, we evaluated the effectiveness of CPI videos. Using the Analytical Hierarchy Process (AHP), decision-makers first evaluated the principles' effect on video attractiveness and visual appeal, then relative weights were combined with expert ratings to get a Utility degree for three alternative videos of 20 mobile games. Results showed that the combination of Gestalt principles and AHP enhances user engagement in CPI videos, achieving high accuracy in identifying the most effective videos when compared with actual CPI values. The research contributes to the role of Gestalt principles in mobile app design and provides a robust and systematic approach for evaluating and improving the design of CPI videos in the mobile gaming industry.

Özet

Bu çalışma, mobil oyun reklamcılığında Yükleme Başına Maliyet (CPI) tahminini optimize etmede Gestalt ilkelerinin rolünü araştırmaktadır. Continuity (devamlılık), closure (bütünlük) ve proximity (yakınlık) gibi ilkelere, renk çeşitliliği, geometrik düzen ve metin yerleşimi gibi alt kriterlerle odaklanarak CPI videolarının etkinliğini değerlendirdik. Karar vericiler, önce Analitik Hiyerarşi Süreci'ni (AHP) kullanarak ilkelerin CPI videosunun görsel çekiciliği üzerindeki etkisini değerlendirdi, ardından göreceli ağırlıklar uzman değerlendirmeleriyle birleştirilerek 20 mobil oyuna ait üç alternatif video için fayda dereceleri elde edildi. Sonuçlar, Gestalt ilkeleri ve AHP kombinasyonunun CPI videolarında kullanıcı etkileşimini artırdığını ve gerçek CPI değerleriyle karşılaştırıldığında en etkili videoları yüksek doğrulukla belirlediğini gösterdi. Bu araştırma, mobil uygulama tasarımında Gestalt ilkelerinin rolüne katkı sağlamakta ve mobil oyun endüstrisinde CPI videolarının tasarımını değerlendirme ve geliştirme için sistematik bir yaklaşım sunmaktadır.

Keywords
Mobile games, design, CPI, Gestalt principles, AHP

Anahtar Kelimeler
Mobil oyunlar, Tasarım, CPI, Gestalt ilkeleri, AHP

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Introduction

The advent of mobile games has brought about a significant transformation in the gaming industry, captivating millions of users globally with their accessible and engaging entertainment (Nam & Kim, 2020). A key determinant of these games' success lies in their capacity to attract and retain users, a task primarily achieved through their creative assets, notably the Cost Per Install (CPI) videos (Wen et al., 2022). CPI videos, encountered by prospective players in the app store or advertisements, are meticulously designed to entice them to download and play the game. CPI value represents the cost paid for an advertisement divided by the number of game downloads. The goal is to achieve a high number of downloads with minimal cost. Therefore, low CPI results are sought in advertising tests conducted with CPI videos. An essential aspect in the effectiveness of CPI videos is their alignment with user preferences. When users choose to engage with a particular CPI video, they are essentially responding to a preference for specific types of content, style, or gameplay that resonates with them. Understanding and predicting these preferences becomes crucial in optimizing CPI, as creating content that aligns closely with what users prefer will likely lower the cost per install while increasing engagement rates.

In optimizing CPI videos, psychology plays a crucial role. The psychological foundations of user interaction with mobile games, particularly through the lens of Gestalt principles, suggest a nuanced design strategy that transcends mere aesthetic appeal. Research by Guo et al. (2019) shows that perceptual alignment facilitated by Gestalt principles can significantly enhance the user's navigation experience and, consequently, their willingness to engage with the game. This integration of psychology into design highlights the interplay between user perception and engagement, suggesting that leveraging cognitive psychology is key to creating compelling CPI videos. As the gaming industry evolves, these insights are vital for attracting and retaining a global audience, thus driving mobile gaming success (Wen et al., 2022; Syvertsen et al., 2022).

The Gestalt principles, encompassing continuity, closure, proximity, similarity, figure-ground, symmetry, and common fate (Wagemans et al., 2012), hold substantial influence over how users perceive and interact with the visual elements in a CPI video, thereby affecting their decision to download the game (Ripalda, Guevara, & Garrido, 2020). Despite their importance, the application of these principles in CPI video design is limited, and their subsequent impact on download rates remains underexplored. This research seeks to address the following research question: How do the Gestalt principles of continuity, closure, and proximity, when applied to CPI video design, influence the effectiveness of these videos in terms of user engagement and download rates? This research aims to address this gap by conducting an in-depth study on the application of Gestalt principles in evaluating CPI video alternatives, utilizing the AHP technique. The AHP is a structured multi-criteria decision-making method used for organizing and analyzing complex problems by breaking them down

into more easily comprehended sub-problems. The AHP facilitates a systematic and objective evaluation of different alternatives based on defined criteria (Saaty, 1990).

In our context, the criteria consist of three fundamental Gestalt principles—continuity, closure, and proximity—along with the sub-criteria of color variation, geometric arrangement, and layout of text. The alternatives to evaluate and compare are the CPI video designs of 20 mobile games. By integrating AHP, we refine the evaluation process for CPI video advertisements, enabling a more accurate estimation of user preferences. Our research is validated by correlating the results of the AHP analysis with the actual CPI test results of the mobile games. This verification enables us to assess the accuracy and effectiveness of using AHP and Gestalt principles in predicting the most efficient CPI video alternative. Based on the findings, the research explores potential ways to improve the estimation of optimal CPI video design using cognitive psychology.

The structure of this paper is organized as follows: The next section covers the theoretical background and methodology, detailing the Gestalt principles and the AHP method. The following section outlines the experimental process, including data collection and the application of AHP to evaluate CPI videos. The subsequent section presents the results and discussion, analyzing the findings and their implications. Finally, the conclusion wraps up the study and suggests directions for future research.

Theoretical Background

Gestalt Principles and Their Role in CPI Video Design

The Gestalt Principles, originating from the German word for "form" or "shape", is a set of laws that govern how humans perceive and interpret their visual environment (Wertheimer, 1938; Wagemans et al., 2012). These principles were initially proposed by German psychologists in the early 20th century and have since been applied across various disciplines, including design and human-computer interaction (Hsiao and Chou, 2006; Polys et al., 2011; Wagemans et al., 2012; Ripalda et al., 2020). Gestalt principles are essential in fields like web design, interface design, and advertising because they help in creating visually appealing and effective designs that enhance user engagement and experience (Hsiao & Chou, 2006). In CPI video design, Gestalt principles are particularly important as they help in organizing visual elements in a way that quickly impacts the user's visual perception, enhancing the overall effectiveness of the video. There are six key Gestalt Principles: similarity, continuity, closure, proximity, figure-ground, symmetry, and common fate. Each of these principles provides unique insights into how humans perceive and interpret visual stimuli. In this study, the selection of three Gestalt principles, continuity, closure, and proximity, is based on their significant impact on the geometric relationships in the images that make up CPI videos for mobile games. Below, each Gestalt principle—continuity, closure, and proximity—will be detailed, explaining their

importance in visual design and how they contribute to the creation of effective and engaging CPI videos.

- The principle of continuity posits that the human eye prefers shapes that flow smoothly, rather than those that change abruptly (Wagemans et al., 2012). This principle is relevant in interface and design aesthetics, influencing perceived attractiveness and ease of use (Bauerly and Liu, 2006). Continuity ensures that the geometric elements within images are arranged in a way that allows the viewer's eye to follow smoothly. This seamless flow makes the visuals easier to process quickly and effectively, enhancing the viewer's understanding of the game in a short time.
- Closure refers to the mind's tendency to "close" gaps and complete unfinished shapes, suggesting that people prefer whole, complete objects rather than those that are incomplete or fragmented (Wagemans et al., 2012). Hsiao and Chou (2006) made use of this principle for the perception of webpage design, and it can be extended to the understanding of CPI video frames. Closure helps viewers perceive a complete image even when parts are missing, allowing them to quickly grasp the game's concept and visual style without needing every detail. This is often used in CPI videos where fragmented images of game objects or settings are perceived as whole entities.
- Proximity is the principle that objects close to each other are perceived as part of the same group (Wagemans et al., 2012). This principle has been highlighted in the context of information-rich virtual environments, including gaming applications (Polys, Bowman, & North, 2011). Proximity organizes related visual elements together, making information easier to process. In CPI videos, elements like game controls, character actions, and interface features are grouped closely to create a clear and intuitive visual structure.

In this study, the sub-criteria of color variation, geometric arrangement, and layout of text have been incorporated to further break down and evaluate how Gestalt principles are applied. These sub-criteria enable a more detailed analysis of how visual design elements support the principles, providing a structured approach to assessing their impact on CPI video effectiveness. The combination of these sub-criteria with Gestalt principles allows for a comprehensive evaluation of how the visual coherence and appeal of the videos are enhanced. Gestalt principles, integral to understanding user interactions with interfaces, significantly influence how users perceive and interact with the visual elements in CPI videos, thereby affecting their preference in downloading the game. These principles are often evaluated through subjective assessments by experts who analyze how well the principles are applied through manipulating design elements (Bauerly & Liu, 2006). This subjective evaluation necessitates the involvement of professional knowledge to ensure accuracy and reliability. In

this study, a Gestalt evaluation process is conducted, gathering insights from decision-makers (DMs) who are experts in the field of cognitive psychology and design.

Analytical Hierarchy Process (AHP)

AHP, developed by Thomas L. Saaty in the 1990s, is a structured technique used for organizing and analyzing complex processes. AHP, which is a special decision-making methodology, is used in a wide variety of fields such as management, industry, education, design, and architecture (Saracoglu, 2013; Li, Chau, & Zeng, 2019). In this study, AHP was chosen due to its ability to systematically break down complex decision-making processes into simpler, more manageable components, providing a structured framework that aligns well with the multifaceted nature of evaluating CPI videos. AHP is a rational framework for defining the problem and relating its criteria, enabling the DMs to choose the most suitable option for their purposes in line with the problem (Forman & Gass, 2001). In AHP, the problem is modeled with a hierarchy of evaluation criteria extending to decision alternatives. At the end of the process, the most suitable one is chosen among the alternatives (Saaty, 2008). By applying AHP, this study aims to objectively quantify subjective assessments of Gestalt principles in CPI video design, ensuring a consistent and unbiased evaluation process.

In the AHP system, where the weights of the decision-making criteria are measured, the relative importance of the criteria is determined by making pairwise comparisons between the criteria (Saaty, 2008). Each DM is expected to compare the relative importance of the dual criteria on a specially produced questionnaire. Unlike many questionnaires that use a 5-point scale, the questionnaire used for AHP is 1 to 9. Firstly, a hierarchy is created from the problem, which is divided into elements related to any aspect of the problem (Bhushan & Rai, 2004). DMs, who make a binary comparison about the relative importance of the created hierarchy elements, use their subjective judgments in addition to their basic knowledge in this comparison, and this is the essence of AHP (Vaidya & Kumar, 2006). The linguistic comparison at the beginning is converted into numerical values that can be processed along the hierarchy in AHP. These numerical data are used to generate a numerical weight for each of the evaluation criteria. Thus, it is aimed to make a rational and consistent comparison in the process. Finally, the weights of the criteria are used to select the most appropriate decision in terms of the targeted alternatives. The weights of the criteria are used to calculate a Utility value for each alternative. The Utility value is a comprehensive score that reflects how well each alternative aligns with the weighted criteria. It is essential for objectively selecting the most appropriate decision in terms of the targeted alternatives, enabling a consistent evaluation process. (Bhushan & Rai, 2004).

In this research, AHP was instrumental in systematically evaluating the Gestalt principles of continuity, closure, and proximity, allowing for a quantifiable comparison of different CPI video designs. Considering the nature of the relationships between Gestalt principles,

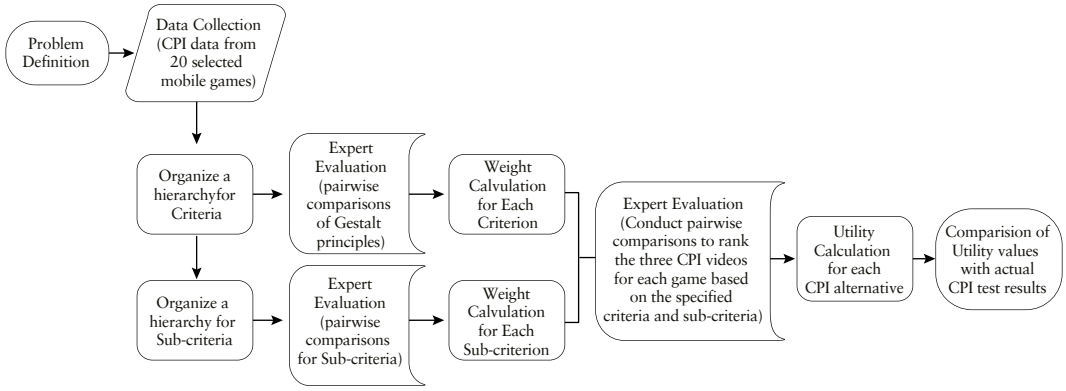
where each operates independently and there is no proven feedback mechanism, AHP, with its hierarchical structure, is more suitable for this study than network-based methods like the Analytic Network Process (ANP), developed by Thomas L. Saaty.

Experimental Process

The experiment is organized into five stages: (1) data collection and expert inclusion process, (2) assessing the importance of Gestalt principles, (3) determining the weights of the sub-criteria, (4) comparing CPI video alternatives, and (5) identifying the Gestalt-based CPI estimation for selected mobile games. These stages are depicted in the flowchart presented in **Figure 1**. The validity of the CPI video evaluations will be verified by comparing them with CPI test data provided by a game company.

Figure 1

Flowchart of the Experimental Stages in Evaluating CPI Videos Using Gestalt Principles



Data collection and expert inclusion process

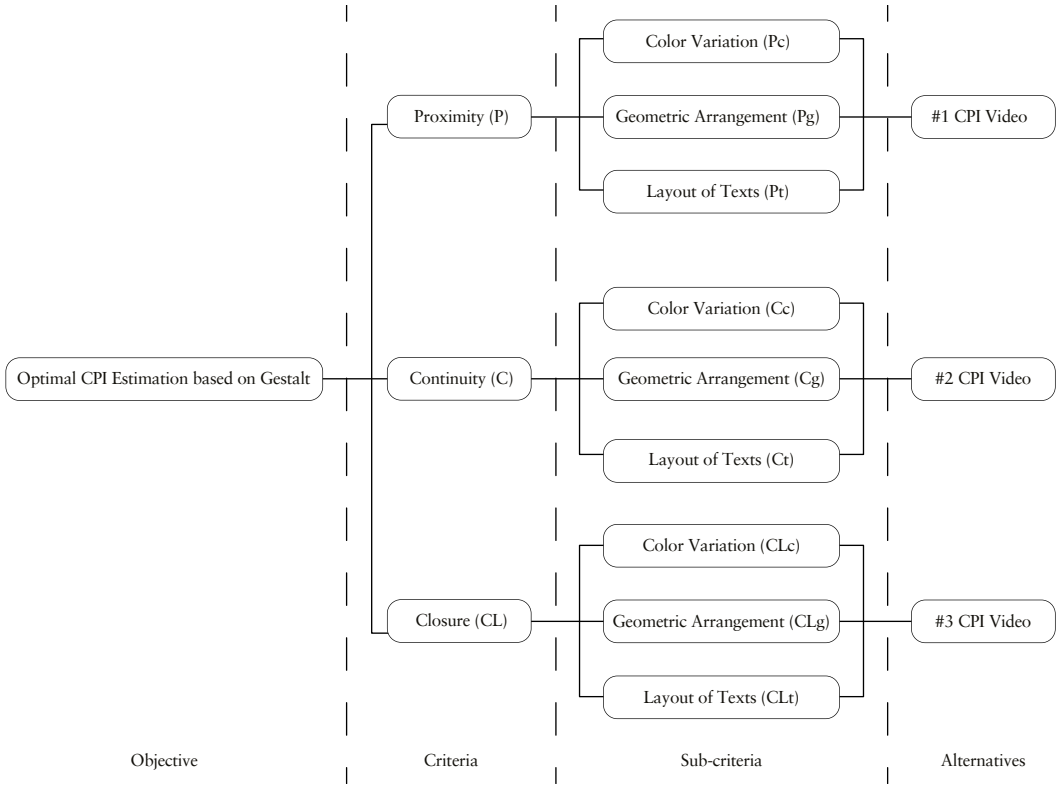
The first stage of the experimentation process involves the collection of CPI data from mobile games belonging to a mobile game company. From an initial pool of 50 mobile games, we selected 20 based on criteria such as significant differences in CPI values, and high levels of visual stimuli. Each mobile game in the study has three alternative CPI videos, each with its own CPI test data. These alternatives are prepared by the game company and presented to the market to gauge effectiveness. The validity of the experiment is confirmed by comparing results with CPI test data obtained from the company. The selection of DMs is a crucial aspect of this study, involving three DMs who are experts in design and cognitive psychology. DM1 is a senior designer and developer with extensive experience in game development, capable of evaluating CPI videos with an understanding of their market implications. DM2 is an academic in cognitive psychology and digital game design who has also worked in the gaming industry, providing insights into both the practical and theoretical aspects of game design. DM3 is a 3-D

generalist specializing in the artistic and perceptual aspects of game design, focusing on visual appeal and user engagement potential. To ensure the evaluations focus on the critical first impression these videos make, the most representative frame between 00:01 and 00:10 of each CPI video was used in the survey. The selection is based on the premise that the initial frames of these videos play a crucial role in attracting user attention and triggering game downloads. Consequently, visuals of the initial frames from each of the CPI videos are captured and used as the primary data for this study.

Assessing the importance of the Gestalt Principles

Figure 2

A hierarchical organization for criteria, sub-criteria, and comparison of CPI Video alternatives



Step 1: Organizing a hierarchy for the relative assessment of criteria.

In the second stage of the experiment, a hierarchy structure (**Figure 2**) is established for the Gestalt principles of proximity, continuity, and closure, upon which three DMs conduct a relative importance assessment for optimal CPI estimation. The principles are evaluated in

terms of their impact on the attractiveness of the CPI frames and, by extension, their potential influence on game downloads. The DMs perform pairwise comparisons for each Gestalt Principle, assigning a value from 1 to 9 to the principle they deem more influential in each pair, as suggested by the AHP method (Saaty, 2008). This process results in a prioritized list of Gestalt Principles, providing insights into which principles are perceived as most influential in making CPI frames attractive to potential game users.

Step 2: Forming the scale of relative importance and pairwise comparison matrix for criteria.

The linguistic expression and numerical equivalents of the 9 values of relative importance are defined: Equal (E = 1), Equal-Moderate (EM = 2), Moderate (M = 3), Moderate-Strong (MS = 4), Strong (S = 5), Strong-Very Strong (SV = 6), Very Strong (VS = 7), Very Strong-Extreme (VEx = 8), Extreme (Ex = 9) as shown in **Table 1**. DMs are expected to make a comparison between any two Gestalt principles, and their responses are used to form the pairwise comparison matrix (**Table 2**). A weight value is calculated for each principle according to the answers of each DM using their matrixes. To determine the importance weights of the principles, which will be used when deciding on the optimal CPI video alternative, the geometric mean of the importance values for each principle's row in the comparison matrix is first calculated. This is done by multiplying the values in the row and then taking the nth root, where n is the number of principles (**Table 3**). Then, the geometric mean value calculated for each principle is divided by the total value of the geometric means, and the importance weight of each principle (**Table 4**) is calculated with the formula:

$$Importance\ Weight = \frac{Mean_i}{\sum_{j=1}^{n} Mean_j}$$

where i represents each principle and n is the total number of principles.

The same steps for calculating weights are applied in subsequent steps to determine the weight values of sub-criteria.

E	Equal	1
EM	Equal-Moderate	2
M	Moderate	3
MS	Moderate - Strong	4
S	Strong	5
SV	Strong – Very Strong	6
VS	Very Strong	7
VSE	Very Strong - Extreme	8
Ex	Extreme	9

Table 1
The scale of relative importance for criteria (Gestalt principles)

	Continuity	Closure	Proximity
Continuity	1	4	6
Closure	1/4	1	1/5
Proximity	1/6	5	1

Table 2
Pairwise comparison matrix for criteria for Game No.7 by DM 1

Continuity	2.88
Closure	0.36
Proximity	0.87

Table 3
Geometric mean

Continuity	0.7
Closure	0.09
Proximity	0.21

Table 4
Weights of criteria

Determining the weights of the sub-criteria

Step 1: Organizing a hierarchy for the relative assessment of sub-criteria.

In this stage, a hierarchy structure is established for the sub-criteria: color variation, geometric arrangement, and layout of texts, upon which three DMs will conduct a relative importance assessment for optimal CPI estimation (**Figure 2**). For the gestalt principles covered in this experiment, color variation, geometric arrangement, and layout of texts may have different relative importance. For example, color variation can be much more effective than the layout of text while defining continuity in a design layout. The decision is made by each DM to be able to calculate their individual assessment for the experimental process.

Step 2: Forming the scale of relative importance and pairwise comparison matrix for sub-criteria

The linguistic expression and numerical equivalents of the 9 values of relative importance are defined: Balanced (B = 1), Balanced-Mildly Inclined (BM = 2), Mildly Inclined (MI = 3), Mildly Inclined-Fairly Intense (MF = 4), Fairly Intense (F = 5), Fairly Intense-Very Intense (FV = 6), Very Intense (VI = 7), Very Intense-Ultra Intense (VIU = 8), Ultra Intense (U = 9) as shown in **Table 5**. DMs are expected to make a comparison between any two sub-criteria, and their responses are used to form the pairwise comparison matrix (**Table 6**). A weight value is calculated for each sub-criteria according to the answers of each DM using their matrixes (**Table 7**) with the same calculation steps as the principle's weights. Then a total weight value for each sub-criterion depending on each principle is calculated as shown in **Table 8** by multiplying the criteria weights (**Table 4**) with the sub-criteria weights (**Table 7**).

B	Balanced	1
BM	Balanced – Mildly Inclined	2
MI	Mildly Inclined	3
MF	Mildly Inclined – Fairly Intense	4
F	Fairly Intense	5
FV	Fairly Intense – Very Intense	6
VI	Very Intense	7
VIU	Very Intense – Ultra Intense	8
U	Ultra Intense	9

Table 5
Scale of relative intensity for sub-criteria: color variation, geometric arrangement, and layout of texts

Table 6
Pairwise comparison matrix for sub-criteria for Game No.7 by DM 1

Continuity			
	Color Variation	Geometric Arrangement	Layout of Texts
Color Variation	1	1/5	4
Geometric Arrangement	5	1	6
Layout of Texts	1/4	1/6	1

Closure			
	Color Variation	Geometric Arrangement	Layout of Texts
Color Variation	1	3	4
Geometric Arrangement	1/3	1	7
Layout of Texts	1/4	1/7	1

Proximity			
	Color Variation	Geometric Arrangement	Layout of Texts
Color Variation	1	3	4
Geometric Arrangement	1/3	1	6
Layout of Texts	1/4	1/6	1

Table 7
Weights of sub-criteria

	Continuity	Closure	Proximity
Color Variation	0.21	0.58	0.59
Geometric Arrangement	0.71	0.34	0.32
Layout of Texts	0.08	0.08	0.09

Table 8
Weights of sub-criteria depending on criteria

Continuity	
Color Variation	0.14
Geometric Arrangement	0.5
Layout of Texts	0.06

Closure	
Color Variation	0.05
Geometric Arrangement	0.03
Layout of Texts	0.01

Proximity	
Color Variation	0.12
Geometric Arrangement	0.07
Layout of Texts	0.02

Comparing CPI Video alternatives

The next stage of the experiment seeks expert opinions related to the Gestalt principles on CPI video alternatives for each of the 20 games. In this phase, the same DMs are asked to evaluate the three CPI videos created for each game by establishing pairwise comparisons based on specified criteria and sub-criteria.

Three different DMs independently assign a value ranging from 1 to 9 to the CPI video they deem more effective in each pairwise comparison. This process results in a ranked list of CPI videos for each game, revealing which video is perceived as most likely to trigger game downloads. By involving three DMs instead of just one, we aim to eliminate bias and achieve more concrete results in this highly subjective design area. This approach allows us to assess the reliability of the raters in applying Gestalt principles and to evaluate the compatibility of each rating with the actual CPI values.

The linguistic expression and numerical equivalents of the 9 values of relative success of the videos are defined: Equitable (EQ = 1), Equitable-Slightly Favoring (EF = 2), Slightly Favoring (SF = 3), Slightly Favoring-Moderately Favoring (SMF = 4), Moderately Favoring (MF = 5), Moderately Favoring-Heavily Favoring (MHF = 6), Heavily Favoring (HF = 7), Heavily Favoring-Exceptionally Favoring (HEF = 8), Exceptionally Favoring (EF = 9) as shown in **Table 9**. DMs are expected to compare any two CPI video alternatives, and their responses are used to form the pairwise comparison matrix. An example of Game No.7 and its three alternative CPI videos (A, B, and C) are given in **Table 10**, showcasing the ratings of DM1. Based on the responses of each DM and the weight values for criteria (derived from earlier AHP steps), calculations are performed for each game. **Table 11** provides a representative sample of these calculations, illustrating the evaluation for Game No.7 by DM1.

EQ	Equitable	1
EF	Equitable – Slightly Favoring	2
SF	Slightly Favoring	3
SMF	Slightly Favoring – Moderately Favoring	4
MF	Moderately Favoring	5
MHF	Moderately Favoring – Heavily Favoring	6
HF	Heavily Favoring	7
HEF	Heavily Favoring – Exceptionally Favoring	8
EF	Exceptionally Favoring	9

Table 9
Scale of relative favoring for CPI Video Alternatives

Table 10

Evaluation of CPI Video Alternatives for Game No.7 by DM 1

Continuity / Color Variation			
	A	B	C
A	1	4	4
B	1/4	1	1/3
C	1/4	3	1

Continuity / Geometric Arrangement			
	A	B	C
A	1	4	4
B	1/4	1	1/3
C	1/4	3	1

Continuity / Layout of Texts *			
	A	B	C
A	1	1	1
B	1	1	1
C	1	1	1

Closure / Color Variation			
	A	B	C
A	1	3	4
B	1/3	1	3
C	1/4	1/3	1

Closure / Geometric Arrangement			
	A	B	C
A	1	4	4
B	1/4	1	3
C	1/4	1/3	1

Closure / Layout of Texts *			
	A	B	C
A	1	1	1
B	1	1	1
C	1	1	1

Proximity / Color Variation			
	A	B	C
A	1	4	5
B	1/4	1	4
C	1/5	1/4	1

Proximity / Geometric Arrangement			
	A	B	C
A	1	3	4
B	1/3	1	3
C	1/4	1/3	1

Proximity / Layout of Texts *			
	A	B	C
A	1	1	1
B	1	1	1
C	1	1	1

* (Since the text layout didn't impact the design much, the DM rated it as 1)

Table 11

Ranking of CPI videos (A, B, and C) depending on sub-criteria

	Continuity		
	Color Variation	Geometric Arrangement	Layout of Texts
Video A	0.65	0.65	0.33
Video B	0.11	0.11	0.33
Video C	0.23	0.23	0.33

	Closure		
	Color Variation	Geometric Arrangement	Layout of Texts
Video A	0.61	0.65	0.33
Video B	0.26	0.23	0.33
Video C	0.11	0.11	0.33

	Proximity		
	Color Variation	Geometric Arrangement	Layout of Texts
Video A	0.66	0.61	0.33
Video B	0.24	0.26	0.33
Video C	0.09	0.11	0.33

Identifying the Gestalt-based CPI estimation for selected Mobile Games

Finally, a Utility value (**Table 12**) for each CPI alternative is calculated by multiplying the importance weights of the criteria and the rating score values for each CPI alternative depending on the criteria, and then adding these values with the formula:

$$Utility = (CriteriaWeight_1)(CPIRanking_1) + (CriteriaWeight_2)(CPIRanking_2) + \ldots + (CriteriaWeight_9)(CPIRanking_9)$$

Table 12

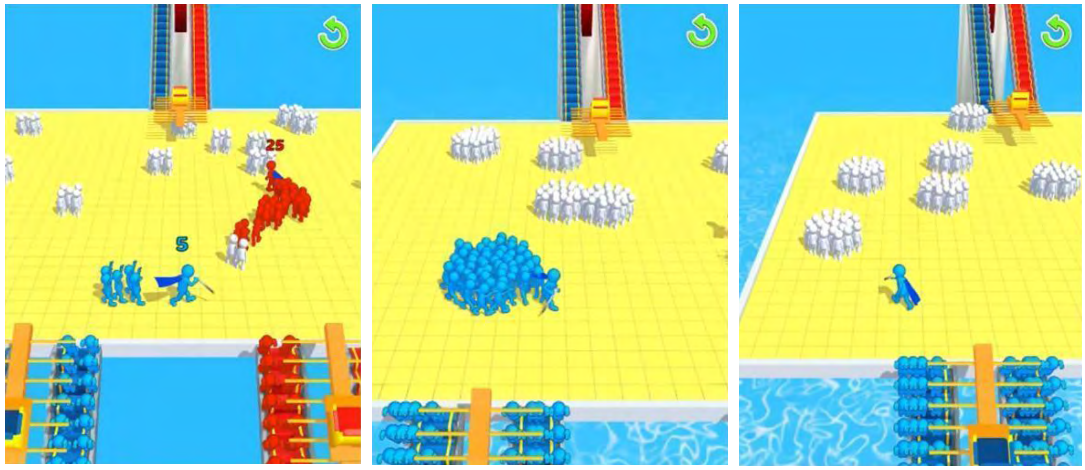
Comparison of the Utilities of CPI Videos and their Actual Test Values for Game No.7 by DM 1

	UTILITY		ACTUAL CPI	
Video A	0.62	1	$0.82	1
Video B	0.17	3	$2.76	3
Video C	0.2	2	$1.80	2

Upon completing these stages, the resulting AHP matrices provide the necessary data for a comparative analysis with the actual CPI results. This analysis aims to determine the level of alignment between the perceived effectiveness of the CPI videos (as determined by the AHP) and their actual effectiveness (as indicated by the CPI test results). **Table 12** shows the CPI test results of Game No.7 (DM1), showing a consistent ranking with the Utility Values of the corresponding video frames. Some examples from the mobile games, including No.7, are given in **Figures 3, 4, 5**, and **6**, with their CPI test values and Utilities. A video with a lower

Figure 3

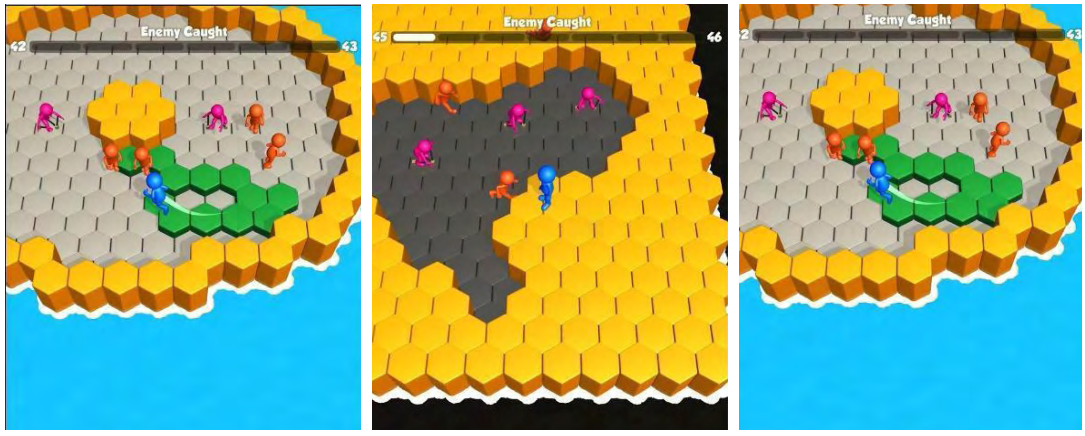
Utilities and actual CPI values for Game No.5 by DM 2



CPI Value: $ 0.89	**CPI Value:** $ 1.19	**CPI Value:** $ 0.66
Utility: 0.19	**Utility:** 0.08	**Utility:** 0.72

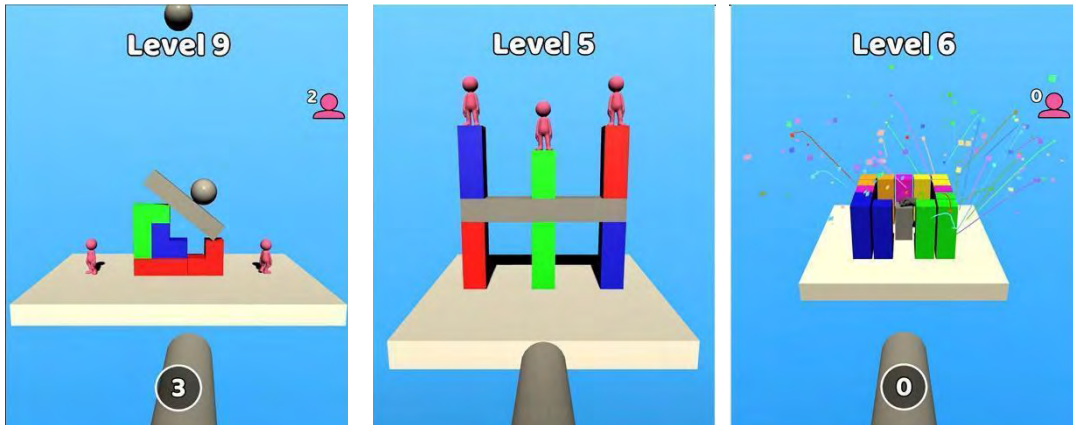
CPI value is more favourable because CPI represents the cost paid for an advertisement divided by the number of game downloads. The goal is to achieve a high number of downloads with minimal cost. In the AHP, a higher numerical utility value indicates a more advantageous option based on the set criteria. Therefore, a low CPI is expected to align with a high utility value, demonstrating the success of the proposed AHP decision model.

Figure 4
Utilities and actual CPI values for Game No.7 by DM 1



CPI Value: $ 0.82	**CPI Value:** $ 2.76	**CPI Value:** $ 1.80
Utility: 0.62	**Utility:** 0.17	**Utility:** 0.2

Figure 5
Utilities and actual CPI values for Game No.16 by DM 2



CPI Value: $ 2.04	**CPI Value:** $ 1.57	**CPI Value:** $ 1.24
Utility: 0.13	**Utility:** 0.18	**Utility:** 0.67

Figure 6
Utilities and actual CPI values for Game No.4 by DM 3

CPI Value: $ 1.32	**CPI Value:** $ 1.33	**CPI Value:** $ 1.65
Utility: 0.52	**Utility:** 0.37	**Utility:** 0.1

Results and Discussion

The results of the study, based on the evaluations of three DMs, provide insights into the strengths and limitations of this methodology in optimizing CPI video design according to Gestalt principles. The utility values and CPI test validation for all selected games, as assessed by Experts DM 1, 2, and 3, are presented in Appendix A. This shows the alignment between the experts' assessments and the actual CPI test results. The expert's ability to predict the entire ranking (1st, 2nd, and 3rd best CPI results) of CPI videos varied (**Table 13**). This comparison highlights the accuracy of using AHP and Gestalt principles in predicting effective CPI videos, although some discrepancies remain.

Table 13
Results

	DM1	DM2	DM3
Predicting Entire Ranking	9 (45%)	7 (35%)	6 (30%)
Predicting Only Best CPI	11 (55%)	14 (70%)	14 (70%)
Completely Incorrect Ranking	3 (15%)	4 (20%)	4 (20%)

DM1 successfully predicted the entire ranking for 9 out of 20 games, yielding an accuracy rate of 45%. DM2 managed to do so for 7 out of 20 games, with an accuracy rate of 35%, while DM3 achieved this for 6 out of 20 games, corresponding to a 30% accuracy rate. These results suggest a moderate level of success in accurately predicting the complete ranking

of CPI videos, indicating that while the combined use of Gestalt principles and AHP can be beneficial, there is room for improvement in refining the prediction models. When focusing on predicting only the best CPI video, the DMs showed higher accuracy. DM1 identified the most effective CPI video in 11 out of 20 cases, translating to a 55% accuracy rate. DMs 2 and 3 both successfully predicted the best CPI video for 14 out of 20 games, achieving an impressive 70% accuracy rate. This finding underscores the potential of Gestalt principles and AHP to effectively pinpoint the most engaging and cost-efficient video among alternatives. It highlights that the methodology is particularly strong in identifying top performers, even if it struggles with the finer classification of ranking all videos accurately. The rate of completely incorrect rankings, where the experts failed to accurately predict the CPI video effectiveness, was relatively low. DM1 had a 15% error rate with 3 incorrect rankings, while DMs 2 and 3 each had a 20% error rate, with 4 incorrect rankings. These low error rates indicate that the methodology generally guided the experts towards reasonably accurate assessments, even if perfect precision was not always achieved. The errors highlight the inherent challenges and subjective nature of applying psychological principles like Gestalt to the highly variable and context-dependent realm of mobile game advertising. Interpretation of these findings sheds light on how specific design elements, influenced by Gestalt principles, contribute to the effectiveness of CPI videos. The success in identifying the top CPI videos underscores the importance of visual coherence and user engagement driven by continuity, closure, and proximity. For example, videos that scored higher in user engagement typically showcased a strong sense of continuity, guiding the viewer's attention smoothly across the content. Closure in these videos allowed users to easily understand and complete visual narratives, even when presented with minimalistic designs. Proximity, by grouping related elements together, helped in making the information more accessible and the gameplay features more appealing. These aspects indicate that the strategic application of Gestalt principles along with the sub-criteria of color variation, geometric arrangement, and text layout, can significantly influence a CPI video's ability to attract downloads and drive user engagement, which are critical factors for designers and marketers in the competitive mobile gaming industry. Cognitive and emotional responses of users to CPI videos could be explored further through user testing methods like eye-tracking or surveys to capture engagement and attention. Additionally, refining AHP could involve dynamic weighting systems influenced by real-time user feedback, such as A/B testing, to better accommodate subjective aesthetic preferences. This would provide a more adaptable and accurate framework for predicting user engagement.

Conclusions and Future Work

The study specifically focused on how Gestalt principles; the criteria of continuity, closure, and proximity, along with sub-criteria; color variation, geometric arrangement, and text layout, influence the effectiveness of CPI videos used in mobile game advertising. By systematically

evaluating these videos through the AHP framework, the study aimed to provide a structured approach for assessing and improving CPI video designs. The study revealed that the experts could predict the best CPI video with a reasonably high degree of accuracy (reaching to 70%). The overall error rates were relatively low, suggesting that the methodology generally provided reasonably accurate assessments. Key findings include the effectiveness of Gestalt principles, where continuity, closure, and proximity were found to be significant in enhancing the attractiveness of CPI videos. These principles, when combined with the sub-criteria of color variation, geometric arrangement, and text layout, contributed significantly to user engagement. The use of AHP allowed for a systematic and objective evaluation of CPI video alternatives, providing a clear hierarchy of the relative importance of different design elements, and enabling more accurate predictions of CPI effectiveness. The utility values calculated through AHP are compatible with actual CPI test results, indicating the practical value of this approach in real-world applications.

The study has limitations, such as the relatively small number of games analyzed and the limited number of expert assessments. Additionally, game specific features (such as sound) and user centered differences (such as demography) were not considered. Future research should include more games and a larger pool of expert opinions to provide a more comprehensive understanding of CPI video effectiveness. Further studies should investigate various ways to expand on this study's findings, such as exploring how cognitive and emotional responses to CPI videos influence user behavior by analyzing user interactions and feedback to gain deeper insights into the factors that drive engagement and downloads. Enhancing the AHP framework to better accommodate the subjective nature of aesthetic evaluations can improve prediction accuracy. This could involve incorporating Fuzzy AHP, which uses fuzzy logic to handle uncertainty and vagueness in pairwise comparisons, providing more robust results. Additionally, applying sensitivity analysis would help understand how changes in criteria weights affect the overall ranking of alternatives. Integrating expert feedback and consensus-building methods, such as Delphi, could also refine judgments and mitigate individual biases, resulting in more balanced comparisons. Expanding the number of games analyzed and using methods like eye-tracking or A/B testing could also refine the weighting systems and capture real-time user feedback, leading to more dynamic evaluations. This may involve developing more sophisticated weighting and comparison mechanisms that can capture the subtle differences in user perceptions. While this study focused on continuity, closure, and proximity, future research could explore the impact of other Gestalt principles, such as similarity, symmetry, and figure-ground, on CPI video effectiveness. Applying the refined methodologies across a larger and more diverse set of mobile games and CPI videos can help validate the findings and ensure their generalizability. This broader application can provide more robust data to fine-tune the evaluation processes. The findings of the study provide valuable insights for game designers and marketers, highlighting the potential for these methodologies to enhance user engagement and optimize advertising effectiveness in the dynamic and competitive mobile gaming industry.

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Appendices

ACTUAL CPI VALUES			DM 1		DM 2		DM 3	
Game 1	A = $0.67	2	0,228294553	3	0,304618628	2	0,203291771	3
	B = $0.58	1	0,509283001	1	0,550679252	1	0,44700504	1
	C = $2.27	3	0,262422447	2	0,14470212	3	0,349703188	2
Game 2	A = $3.69	2	0,297881194	2	0,13452812	3	0,138312569	3
	B = $3.61	1	0,482214323	1	0,203784651	2	0,20401661	2
	C = $6.26	3	0,219904482	3	0,661687229	1	0,65767082	1
Game 3	A = $0.91	1	0,205041931	3	0,576995449	1	0,196019725	3
	B = $1.31	2	0,316274713	2	0,150047834	3	0,33820229	2
	C = $1.57	3	0,478683356	1	0,272956717	2	0,465777984	1
Game 4	A = $1.32	1	0,566776116	1	0,441044223	2	0,523003018	1
	B = $1.33	2	0,287370072	2	0,44209498	1	0,375236368	2
	C = $1.65	3	0,145853812	3	0,116860797	3	0,101760614	3
Game 5	A = $0.89	2	0,336827761	2	0,197438211	2	0,385481076	2
	B = $1.19	3	0,220180566	3	0,081749519	3	0,201140799	3
	C = $0.66	1	0,442991673	1	0,72081227	1	0,413378125	1
Game 6	A = $1.57	2	0,402938313	2	0,334875587	2	0,417058032	2
	B = $1.56	1	0,41573838	1	0,489684708	1	0,43757746	1
	C = $2.52	3	0,181323306	3	0,175439705	3	0,145364508	3
Game 7	A = $0.82	1	0,62296596	1	0,692577548	1	0,631540138	1
	B = $2.76	3	0,171200964	3	0,21178707	2	0,245957958	2
	C = $1.80	2	0,205833075	2	0,095635382	3	0,122501903	3
Game 8	A = $2.13	3	0,3312533	2	0,240238538	2	0,309679379	2
	B = $0.98	2	0,172669473	3	0,549578128	1	0,145049693	3
	C = $0.53	1	0,496077227	1	0,210183335	3	0,545270928	1
Game 9	A = $1.22	2	0,439971294	1	0,139913831	3	0,176016696	3
	B = $1.26	3	0,196701536	3	0,24276885	2	0,268047242	2
	C = $0.82	1	0,36332717	2	0,617317319	1	0,555936062	1
Game 10	A = $0.77	1	0,423196522	2	0,622404942	1	0,619058873	1
	B = $1.24	2	0,43277597	1	0,223579719	2	0,24434915	2
	C = $1.67	3	0,144027508	3	0,154015339	3	0,136591977	3
Game 11	A = $0.19	1	0,339144311	2	0,594127789	1	0,314926813	2
	B = $0.30	2	0,431776388	1	0,21875259	2	0,395590726	1
	C = $0.19	1	0,2290793	3	0,187119622	3	0,289482461	3

ACTUAL CPI VALUES			DM 1		DM 2		DM 3	
Game 12	A = $0.26	1	0,355415998	2	0,416001639	1	0,434246866	1
	B = $0.38	2	0,460375237	1	0,31613604	2	0,222107477	3
	C = $1.14	3	0,184208766	3	0,267862321	3	0,343645657	2
Game 13	A = $1.37	1	0,550166644	1	0,194473882	2	0,538437693	1
	B = $1.67	2	0,230238172	2	0,148919892	3	0,210570642	3
	C = $1.95	3	0,219595185	3	0,656606226	1	0,250991665	2
Game 14	A = $1.63	2	0,54312779	1	0,258858137	3	0,594471394	1
	B = $1.19	1	0,32026758	2	0,462523107	1	0,278792899	2
	C = $2.11	3	0,13660463	3	0,278618756	2	0,126735707	3
Game 15	A = $1.13	1	0,29739922	2	0,137057903	3	0,207396246	3
	B = $1.84	2	0,473912503	1	0,194845601	2	0,279431268	2
	C = $1.92	3	0,228688277	3	0,668096496	1	0,513172486	1
Game 16	A = $2.04	3	0,253287508	3	0,136384391	3	0,271614123	2
	B = $1.57	2	0,482858967	1	0,186086749	2	0,46138953	1
	C = $1.24	1	0,263853524	2	0,677528859	1	0,266996347	3
Game 17	A = $0.85	2	0,238892708	2	0,211387807	3	0,282535054	2
	B = $1.43	3	0,112454671	3	0,263680071	2	0,114386359	3
	C = $0.58	1	0,648652622	1	0,524932123	1	0,603078587	1
Game 18	A = $4.40	2	0,137892669	3	0,101760466	3	0,125499746	3
	B = $23.60	3	0,460641301	1	0,176524967	2	0,202900201	2
	C = $2.25	1	0,40146603	2	0,721714567	1	0,671600053	1
Game 19	A = $1.95	1	0,487100514	1	0,211879641	3	0,499618478	1
	B = $4.48	3	0,128858645	3	0,22682095	2	0,139544822	3
	C = $2.65	2	0,384040842	2	0,561299409	1	0,3608367	2
Game 20	A = $1.22	1	0,628489334	1	0,543701329	1	0,46764898	1
	B = $1.97	2	0,191153829	2	0,245953447	2	0,243503898	3
	C = $2.02	3	0,180356837	3	0,210345224	3	0,288847122	2

Appendix A: Utility Values and CPI Validation of Selected Games by DMs 1, 2, and 3

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