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CULTURAL CREATIVE AR GAME AND SIDE EFFECTS EVALUATION

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ABSTRACT

In cultural creative industry, mobile games are one of the most increasing markets. Pokemon Go, as an Augmented reality (AR) in mobile games, may lead to both video game and physical activity, but it also inevitably triggers a certain degree of side effects. Unfortunately, there is little objective, scientific research focused on evaluating the risks of side effects that result from information exchange among mobile devices. In this study, the Grey Relational Analysis (GRA) is employed to identify and evaluate the risks of Pokemon Go. This research finds "Walking or car accident", "Disturbing sacred location", and "Trespassing" are the top three side effects. Cultural creative game is a new inevitable business trend, it is an unavoidable responsibility to our society to govern and constitute a legal environment for those AR game players.

Indexing terms/Keywords

Cultural creative, Pokemon Go, GRA

INTRODUCTION

In 2016 Pokemon Go launched new versions of cultural creative game, it is a location-based augmented reality game developed by Niantic for iOS and Android devices. Although the game is free to play, it supports in-app purchases, where players can purchase additional Poké Balls and other in-game items[1]. Stores pay fees to have much more Pokemon characters lured to the store, and draw in more players that the store sales profit goes up. Therefore, the Nintendo's stock price was boosted 25 percent [2]. Since there is money transaction through internet there will be risks during the on-line trade.

Not only personal use of mobile services such as webmail, facebook, YouTube for some years, but also personal use of mobile devise in cultural creative industry as a tool for their video games. Technology has progressed so rapidly that Internet marketing has become more and more important in the "marketing mix" [3]. In the past ten years especially, the economy and society have changed rigorously, and not only the incomes of consumers but also the dollar amounts of purchases have risen. Consumers' habits of purchasing game related products are more different than ever. In order to occupy this market, most cultural creative industry have invested plenty of resources and man power in mobile game devices in order to provide the new business opportunities and increased convenience the Internet can provide, through which customers can purchase their game related products.

As a result, this study has the following objectives:

- Identify the side effect evaluation factors attributable to AR game services using scientific and objective methods;
- Measure and analyze side effect evaluation factors from AR games;
- Provide administrators with the side effect information necessary to make decisions with regard to AR games;
- Provide support for management's authorization of AR games based on objective, scientific, risk-focused assessments.

Literature Review

While the AR mobile game is growing, the side effects of this industry cause some problem or even more serious damage. One of the most serious side effects is accident that cause injury or even death. On July, 2016, it was reported that a boy in Central America was shot and killed while playing the game in the late evening hours[4]. Car accident was also occurred because of playing AR games. A distracted driver playing the game killed one woman and seriously injured another. The farmer did not notice the women crossing a street and struck them with his truck. The woman died of a broken neck[5].

The mobile game was also criticized for using locations such as cemeteries and memorials as playing sites. For example, in 9/11 Memorial, there are at least four Pokéstops at the landmark — including the twin memorial pools that feature the names of every person who died in the terrorist attacks[6]. To peace the anger of people, Niantic later removed content from sensitive areas such as the Hiroshima Memorial and Holocaust Museum[7].

Pokemon may also have legal problems related to jurisdiction, and agreement or contract risks. In many cases, vendor servers span multiple countries with different compliance and data privacy laws, making it unclear which legal entity has jurisdiction over the data〔8, 9〕. Mobile games also raises potential legal issues between game player and AR game provider 〔10, 11〕. The apportionment of liability in a mobile game contract may be unclear, or a user may get locked into a contractual arrangement that does not cater to the user's needs. The AR game infrastructure must address challenges beyond the traditional issues of remote access, data transfer, and intrusion detection and control through

constant system monitoring〔9〕. Mobile games' unique schema for physical data storage may sufficiently store the data of multiple clients on one physical device. This shared physical server model requires the vendor to ensure that each customer's data are kept separate, so that no data bleeding occurs across virtual servers〔11〕. Furthermore, enterprises and individuals interested in using mobile games services must be aware of the privacy risks associated with their use and take these risks into account when deciding to use mobile games services 〔12〕.

Personal information of members is another issue concerning the privacy. In other words, the use of mobile games services implies system vulnerability associated with malicious employees〔13〕. Unfortunately, not all security breaches in mobile games are caused by cloud service providers. Employees' mistakes may also result in security breaches 〔14〕. The sensitive data of each enterprise resides within the enterprise itself and is subject to its physical, logistical, and personnel security control policies in a traditional model of on-premises application deployment〔8〕. However, in most mobile games service models, enterprise data are stored externally. Because malicious users can exploit weaknesses in the data security model to gain unauthorized access to data, mobile games vendors are urged to adopt additional security measures to prevent breaches. One example is the use of weak security passwords or a standard company default password to log on to a network or e-mail platform〔13〕.

To draw a conclusion from the prior literature review (a) Agreement or contract, (b) Privacy, (c) Walking or car accident, (d) Damaged or spoiled by employees, (e) Burglary, (f) Disturbing sacred locations, (g) Trespassing, (h) System vulnerability, (i) Traffic jam, (j) Jurisdiction are ten risks of mobile games. This study also conducted a Delphi study and the Grey Relational Analysis (GRA) to identify the side effects of the Pokemon Go and the relative weights of each side effect.

Methodology

The participants (N = 10) were selected by purposive sampling of people who were managers or related experts in travel agencies. Purposive sampling is mainly used for opinion surveys. For this study, participants were required have been in the travel agent business for at least 5 years. Interviews were conducted via phone with ten participants, five from travel agents in Taiwan, and five from the college teachers in tourism department.

The questionnaire is composed of two parts. First the questionnaire addresses demographics, including gender, age, professional position, marriage, number of kids, part-time job, and education. Second, the questionnaire addresses the characteristics of travel agency salespeople, using 10 items of responds to the rising application of mobile channel. The answers are constructed with the Likert scale. The interviews protocol was developed in English and based on the literature review. The interviews explored more fully the perceptions of the people of experience about the travel agent and mobile channel. Interviews were conducted in Chinese. The codes and supporting words emerging from the transcripts of interviews were translated into English for analyzing.

Grey Relational Analysis Methodology.

The grey system method, as developed by Deng [15], has been extensively applied in various fields, including decision science. In this study, the GRA is applied to construct an evaluation method for selecting the risk management factors of travel business with mobile channels in Taiwan. The GRA is calculated as follows:

Let X_0 be the referential series with k entities (or criteria) of $X_1, X_2, \ldots, X_i, \ldots, X_N$ (or N measurement criteria). Then

$$X_0 = \{x_0(1),\ x_0(2),\ \ldots,\ x_0(j),\ \ldots,\ x_0(k)\},$$

$$X_1 = \{x_1(1),\ x_1(2),\ \ldots,\ x_1(j),\ \ldots,\ x_1(k)\},$$

$$\vdots$$

$$X_i = \{x_i(1),\ x_i(2),\ \ldots,\ x_i(j),\ \ldots,\ x_i(k)\},$$

$$\vdots$$

$$X_N = \{x_N(1),\ x_N(2),\ \ldots,\ x_N(j),\ \ldots,\ x_N(k)\}.$$

The grey relational coefficient between the compared series X_i and the referential series of X_0 at the j-th entity is defined as

$$\gamma_{0i}(j) = \frac{\Delta\min + \Delta\max}{\Delta_{0j}(j) + \Delta\max}, \qquad (1)$$

where $\Delta_{0j}(j)$ denotes the absolute value of difference between X_0 and X_i at the j-th entity,that is

$\Delta_{0j}(j) = |x_0(j) - x_i(j)|$, and $\Delta\max = \max_i \max_j \Delta_{0j}(j)$, $\Delta\min = \min_i \min_j \Delta_{0j}(j)$.

The grey relational grade (GRG) for a series of X_i can be expressed as

$$\Gamma_{0i} = \sum_{j=1}^{K} w_j \gamma_{0i}(j), \qquad (2)$$

Where w_j represents the weight of j-th entity. If the weight does not need to be applied, take $\omega_j = \frac{1}{K}$ for averaging.

Before calculating the grey relation coefficients, the data series can be treated based on the following three kinds of situation and the linearity of data normalization to avoid distorting the normalized data [16]. They are:

1. Upper-bound effectiveness measuring (i.e., larger-the-better)

$$x_i^*(j) = \frac{x_i(j) - \min_j x_i(j)}{\max_j x_i(j) - \min_j x_i(j)}, \qquad (3)$$

where $\max_j x_i(j)$ is the maximum value of entity j and $\min_j x_j(j)$ is the minimum value of entity j.

2. Lower-bound effectiveness measuring (i.e., smaller-the-better)

$$x_i^*(j) = \frac{\max_j x_i(j) - x_i(j)}{\max_j x_i(j) - \min_j x_i(j)}, \qquad (4)$$

$$\text{If } \min_j x_i(j) \le x_{ob}(j) \le \max_j x_i(j), \text{ then } x_i^*(j) = \frac{|x_i(j) - x_{ob}(j)|}{\max_j x_i(j) - \min_j x_i(j)}, \qquad (5)$$

$$\text{If } \max_j x_i(j) \le x_{ob}(j), \text{ then } x_i^*(j) = \frac{x_i(j) - \min_j x_i(j)}{x_{ob}(j) - \min_j x_i(j)}, \text{ or} \qquad (6)$$

$$\text{If } x_{ob}(j) \le \min_j x_i(j), \text{ then } x_i^*(j) = \frac{\max_j x_i(j) - x_i(j)}{\max_j x_i(j) - x_{ob}(j)}. \qquad (7)$$

where $x_{ob}(j)$ is the objective value of entity j.

Data Analysis

Table 1. Questionair data of the risk management factors

Factors \ Expert	1	2	3	4	5	6	7	8	9	10
Agreement or contract	5	5	3	4	5	4	3	5	5	5
Jurisdiction	4	5	5	4	5	5	4	4	5	5
Damaged or spoiled by employees	4	5	4	4	3	4	3	4	4	4
Burglary	3	4	3	4	2	3	4	2	3	4
Normal wear and tear or malfunction	3	4	3	2	3	2	2	3	2	3
Natural disaster	2	3	3	2	2	3	2	3	3	2
System vulnerability	3	4	4	4	3	4	4	4	4	4
Mistakes made by employees	4	3	4	3	4	4	5	4	5	5
Social engineering	4	5	4	5	4	4	5	4	4	4
Privacy	5	3	3	4	2	3	4	3	3	3

Calculation of $\Delta_{0j}(j)$ equals the difference between X_0 and X_i .The result is in table 2。

Table 2.the calculation result of $\Delta_{0i}(j)$ of the risk management factors

	1	2	3	4	5	6	7	8	9	10
Δ_{01}=	0.0000	0.0000	2.0000	1.0000	0.0000	1.0000	2.0000	0.0000	0.0000	0.0000
Δ_{02}=	1.0000	0.0000	0.0000	1.0000	0.0000	0.0000	1.0000	1.0000	0.0000	0.0000
Δ_{03}=	1.0000	0.0000	1.0000	1.0000	2.0000	1.0000	2.0000	1.0000	1.0000	1.0000
Δ_{04}=	2.0000	1.0000	2.0000	1.0000	3.0000	2.0000	1.0000	3.0000	2.0000	1.0000
Δ_{05}=	2.0000	1.0000	2.0000	3.0000	2.0000	3.0000	3.0000	2.0000	3.0000	2.0000
Δ_{06}=	3.0000	2.0000	2.0000	3.0000	3.0000	2.0000	3.0000	2.0000	2.0000	3.0000
Δ_{07}=	2.0000	1.0000	1.0000	1.0000	2.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Δ_{08}=	1.0000	2.0000	1.0000	2.0000	1.0000	1.0000	0.0000	1.0000	0.0000	0.0000
Δ_{09}=	1.0000	0.0000	1.0000	0.0000	1.0000	1.0000	0.0000	1.0000	1.0000	1.0000
Δ_{010}=	0.0000	2.0000	2.0000	1.0000	3.0000	2.0000	1.0000	2.0000	2.0000	2.0000

Employ an application with the linearity of data normalization to avoid distorting the normalized data。The calculation result is in Table 3.

Table 3. The result of the linearity of data normalization

	1	2	3	4	5	6	7	8	9	10
γ_{01}=	1.0000	1.0000	0.4286	0.6000	1.0000	0.6000	0.4286	1.0000	1.0000	1.0000
γ_{02}=	0.6000	1.0000	1.0000	0.6000	1.0000	1.0000	0.6000	0.6000	1.0000	1.0000
γ_{03}=	0.6000	1.0000	0.6000	0.6000	0.4286	0.6000	0.4286	0.6000	0.6000	0.6000
γ_{04}=	0.4286	0.6000	0.4286	0.6000	0.3333	0.4286	0.6000	0.3333	0.4286	0.6000
γ_{05}=	0.4286	0.6000	0.4286	0.3333	0.4286	0.3333	0.3333	0.4286	0.3333	0.4286
γ_{06}=	0.3333	0.4286	0.4286	0.3333	0.3333	0.4286	0.3333	0.4286	0.4286	0.3333
γ_{07}=	0.4286	0.6000	0.6000	0.6000	0.4286	0.6000	0.6000	0.6000	0.6000	0.6000
γ_{08}=	0.6000	0.4286	0.6000	0.4286	0.6000	0.6000	1.0000	0.6000	1.0000	1.0000
γ_{09}=	0.6000	1.0000	0.6000	1.0000	0.6000	0.6000	1.0000	0.6000	0.6000	0.6000
γ_{010}=	1.0000	0.4286	0.4286	0.6000	0.3333	0.4286	0.6000	0.4286	0.4286	0.4286

After calculation, the main impact factors of the risk management factors were decided. The result is in Table 4.

Table 4.Grey relational grade (GRG) of the risk management factors

Risk Management Factors	γ_{0i}
Agreement or contract	0.8057
Jurisdiction	0.8400
Damaged or spoiled by employees	0.6057
Burglary	0.4781
Normal wear and tear or malfunction	0.4076
Natural disaster	0.3810
System vulnerability	0.5657
Mistakes made by employees	0.6857
Social engineering	0.7200

Privacy	0.5105

According to γ_{0i}, the priority of the main impact factors of the risk management factors is listed as the follows:

FACTOR2> FACTOR1 > FACTOR9 > FACTOR8 > FACTOR3 > FACTOR7 > FACTOR10 > FACTOR4 > FACTOR5 > FACTOR6

Conclusion

Through the process of GRA, the most influencing side effects selected by the interviewers were"Walking or car accident", "Jurisdiction", and "Trespassing". When AR in cultural creative games is inevitable, it is a responsibility for our community to understand the consequences of the side effects and redesign the application of augment reality.

The first impacting side effects is "Walking or car accident". Pokemon Go players prefer to gather in a place with frequent presence of Pokemon to catch. The problem is if the place is on the traffic busy area, it will cause walking accident or even car accident. How to control the presence of Pokemon on those traffic busy area is the key issue that both the traffic control administration and the Pokemon Go designer should discuss. Maybe, how to limit the catch angle of Pokemon that only the player on the walking pavement but the player on the driving road could catch Pokemon is another design management.

The second consideration is jurisdiction. Jurisdiction is the practical authority to interpret and apply the law. Since augment reality game is a new inevitable model of cultural creative game, and the creating company is not registered on the implicated country, how to govern and constitute a legal environment is a responsibility to our legislators. Or there will be potential cost while there is conflict between the customer and the third victim. Therefore, how to lobby the legislators to constitute a safe environment for the Pokemon player is an urgent assignment right now.

Trespassing is also a side impact for the resident or property owner. In order to catch Pokemon, the player does not notice if it is the region of a private property that a trespassing will cause an inconvenience for the residents. What is a reasonable region of a property? Is the image of the property the right of the resident or the owner? When the augment reality keeps growing, those questions will raise until those problem reach a much more clear definition.

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