An Association Analysis Between Content Topic and Appeal Type of Infographics

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Abstract. Infographics become viral on the internet and social media, offering people visual information in an easy way to consume and share. The design, story, and data all play an important role in infographic. However, the latter two were less explored than the first one. Hence, this study conducted an association analysis between the two variables, "content topic" and "appeal type" from the infographics which received more than 10000 page views on Visual.ly. The study comprised the two phrases. Phase 1 aimed to classify the categories for both the two variables by card sorting and cluster analysis. Next, association analyses were performed in phase 2 to discover the connections between the two important factors of infographics. The results were as follows. (1) The content type was divided into the four categories: "statistical data", "original insight", "life issues" and "development progress". (2) Web infographics adopting "rational appeal" were more than those adopting "emotional appeal". (3) A significant association did exist between content type and appeal type. Rational appeal was usually used with the contents of statistical data, and emotional appeal was usually applied in the topics of development progress and life issues. Overall, the findings could serve as a foundation for further studies in infographic, and enable designers to enhance users' experience in visual communication.

Keywords: Infographic · Content topic · Appeal type

1 Introduction

1.1 Background Information

Infographics is a visual representation of knowledge to convey message in a quick and concise way. With the coming of digital age, internet becomes an important platform for people to communicate with each other, leading that a new breed of infographic has evolved to be for mass communication in blogs or social media and been an excellent tool for commercial marketing in recent years (Rendgen and Wiedemann 2012). To fit within a width of web media, this new infographic turns into a long and skinny form (Lankow et al. 2012).

Infographics is a combination of information and graphic, meaning that both are the main elements. Compared to graphic, information issue is less explored in the field of infographic. Slembrouck (2011) pointed out that information consists of graphic, data,

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and storying, implying that the latter two factors are essential to probe into the information aspect of infographic. From the viewpoint of commercial profit, peoples' attentions mean huge potential of economic value, resulting that attention turns into a crucial and rare resource (Davenport and Back 2002). Hence, infographic with stunning visuals is applied widely in social media platform. Laskey et al. (1995) pointed out that effects of communication are influenced by content and appeal of product. In contrast to infographic, these two properties are quite similar to data and storytelling. The former is the theme of selected content, and the latter is an approach to guide people with a specific content to generate resonance. Therefore, this study took "content topic" and "appeal type" as the two factors to explore the info aspect of infographic. (Fig. 1).

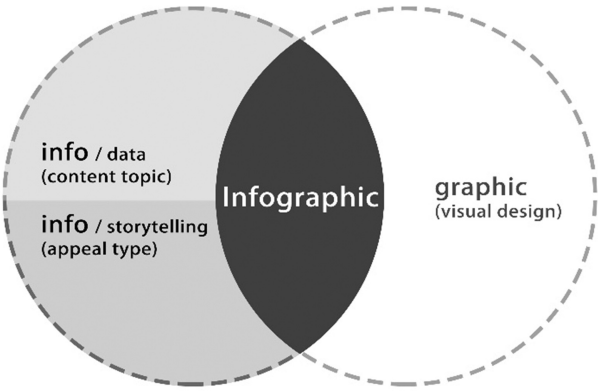

Fig. 1. Main factors of infographic

Advertisement is a typical application of information design. The message content conveyed through advertising usually focus on the characteristics, benefit, or features of the product or the service (Rotzoll et al. 1989). Except for informativeness, the entertainment is also necessary for content (Steinbock 2007). Hence, letting people has an experience with fun is an important issue in modern marketing in order to leave them with a message to take away. As for infographic, clarifying the categories of content topic people are interested in will provide valued references for academic research and design practice.

Moreover, appeal means an approach seeking to build a link between the content and viewers' resonance. Design and marketing staff attempt to achieve an effective communication through various appeal types (Hsiao 1991). In order to choose an appropriate classification for infographic, this study collected related scholars' viewpoints and integrated them in Table 1.

The numbers of types might be different; however, there is a general agreement in among most of them in classifying appeals: rational/emotional appeal, which is been widely used in related researches (Rothschild 1987; Ju 1995; Turley and Kelley 1997). Hence, it was took as basis of appear type in this study, and been described as followed.

Table 1. List of related appeal types

Scholar	Types
Vanghn (1980)	Think/Feel
Aaker and Norris (1982)	Informational/Rational/Image/Cognitive/Emotional/Feeling
Puto and Wells (1984)	Informational/Transformational
Snyder and DeBono (1985)	Functional appeal/Symbolic appeal
Rossiter and Percy (1987)	Positive/Negative
Johar and Sirgy (1991)	Utilitarian appeal/Value-expressive appeal
Kotler (1991)	Rational appeal/Emotional appeal/Moral appeal
Ju (1995), Turley and Kelley (1997)	Rational/Emotional

- Rational appeal: This approach aims to focus on conveying functional, utilitarian, or practical message to persuade viewers.
- Emotional appeal: This approach is concerned with people's psychological and social needs in order to gain recognition.

In order to measure the appeal type of various message media, a linker scale is a common tool adopted in many researches (Chen 2003; Lin and Tu 2006). For instance, Lin and Tu (2006) used seven-point Likert scale with following the two questions: (1) this commercial focuses on delivering the message with value, function, or benefit. (2) this commercial focuses on delivering the personal, social, emotional, humor message. Then the stimuli was classified based on participants' subjective scoring. Therefore, this study used seven-point Likert scale to measure the appeal type infographic adopted.

1.2 Research Questions

The survey and analysis of this study would clarify cognition of infographic, and enable designers to enhance users' experience in visual communication. Overall, the research questions were as follows.

1. Classifying the categories of content topic of infographic.
2. Survey on the proportion of appeal type adopted by infographic.
3. Examining the association between content topic and appeal type.

2 Experiment

2.1 Method

Classification is a method to explore construction of knowledge. The process of assigning the stimuli into groups by similarities can enable the clarification of commonality and differentiation among groups. Hence, the methodology of this study was as follows.

1. A card sorting was used as a tool to classify the content topic of stimuli by participants. Additionally, based on the angle of rational and emotional appeals, a seven-points of Likert Scale was adopted to measure the appeal type of stimuli by participants' subjective scoring.
2. The assignment results of all participants were analyzed by cluster analysis to find the commonality within each cluster and the differentiation among clusters. Both the dendrogram and agglomeration schedule were used to determinate the numbers of clusters. The former is a tree diagram for illustrating the arrangement of clusters, and the latter is a numerical summary descripting the combination process of the cluster of stimuli.
3. After classifying both the content type and appeal type of stimuli, an association analysis was performed to uncover the relationships between these two variables in order to identifies how content topic are associated with appeal type of infographics.

2.2 Stimuli

According to Alexa Internet top 500 sites analytics (Alexa 2015), Visual.ly is the infographic website with most page views in recent years. The infographics with more than 10000 views from Visual.ly Community were sampled as the stimuli.

To reduce variability and experiment overload, these stimuli were filtered and examined by the three reviewers with more than 6 years experiences in graphic design and infographic based on quality evaluation of design, communication, and visual storytelling (Kimura 2010). The reviewers assigned each stimulus to one of five options: "strongly agree", "agree", "neither agree nor disagree", "disagree", or "strongly disagree". A stimulus would be preserved if it obtained a "strongly agree" or "agree" score from at least two reviewers. Finally, 203 infographics were sampled as the stimuli for experiment.

2.3 Participants

To ensure reliability and validity of card sorting data, Gaffney (2000), Tullis and Wood (2004) recommend 30 as a proper number of participants. Thus, 30 senior undergraduates in design related courses from Chung Yuan Christian University took part in the experiment. All were 22 years old, gender balanced, and obtained a certificate of high-intermediate level of General English Proficiency Test.

2.4 Variables

The definitions of the variables were as follows.

1. Content topic: it refers to a theme conveyed by infographic. The content topic of each stimulus is determined by classification using card sorting and cluster analysis by all participants.

2. Appeal type: it refers to an approach to develop a link between information and the people's approval. "Rational appeal" and "emotional appeal" are two broad types (Ju 1995). The appeal type of each stimulus is determined by cluster analysis on subjective scoring using seven-point Likert scale by all participants.

2.5 Procedure

The procedure of experiment was as follows.

1. Apparatus: An ACER Laptop (Intel i7-3612 Processor, 4096 MB RAM, 15-inch screen, resolution of 1366 * 768 pixels) was prepared with ACDSee Pro 2 software for participants to view, rearrange, and classify stimuli.
2. Procedure: The experiment was preceded by appointment. Before each experiment, the researcher gave out the instructions regarding classifying stimuli into groups based on similarities of content topic and scoring appear type by seven-point Linkert scale in the questionnaire. When there were no further questions, the experiment was begun without time limitation.
3. Data registering: Upon completion of the experiment, the researcher registered the stimuli in all clusters. Moreover, an interview was conducted and recorded if the participant's reasons for assigning and scoring stimuli in order to clarify each group characteristics and differences in the clustering process.

2.6 Statistical Analysis

Following these procedures, 30 valid data sets were obtained and then analyzed by cluster analysis to build a clustering hierarchy based on distance or similarity of observations. The analysis procedures were as follows.

1. Distance matrix: The data of card sorting were to be converted into a distance matrix, a numerical form of data which could be analyzed through cluster analysis. Parser for Cluster Data, from the Computer Aided Kansei Engineering (CAKE) software by Chuang and Chen (2004) was used as the tool to convert the collected data into distance matrix.
2 Cluster analysis: The distance matrix obtained through CAKE was then analyzed by the hierarchical clustering function of SPSS software for cluster analysis, generating the classification results.
3. Chi-square test: Finally, the frequency distribution of stimuli was build based on the classification results, and calculated for association between the two categorical variables: content topic and appeal type.

3 Results

3.1 Cluster Analysis of Content Topic

In order to classify the content type, the process of cluster analysis was represented in the two forms. One is a dendrogram, which is a tree structure of clustering process rescaled into a range from 0 to 25. The other is an agglomeration schedule table, showing (1) the stage of clustering order and cluster of stimuli to be merged at each stage, (2) the coefficient registering distance as stimuli were merged, and (3) the difference of coefficient values between its stage and next stage. Usually, the maximum difference was considered to be an indicator to stop clustering (Huang 2000). Thus, this study adopted the stage of maximum difference as the critical point to decide the number of content type.

The agglomeration schedule was summarized in Table 2, which extracted the stages of first clustering in each cluster and when the stage clustering stopped. When the stimulus 6 were merged into the group of stimulus 3 at stage 199, the difference between stage 199 and 200 registered the maximum of 18.192, revealing it as the critical point to stop clustering.

Table 2. Summary of agglomeration schedule of content type

Stage	Cluster combined		Coefficients	Difference	Stage cluster first appears		Next stage
	Cluster 1	Cluster 2			Cluster 1	Cluster 2	
1	200	203	0	0	0	0	4
5	182	140	0	0	0	0	16
11	158	76	0	0	0	0	19
37	28	68	0	0	0	0	45
199	6	3	16.070	18.192*	196	196	200

*Maximum of difference

Meanwhile, four clusters were found after the combination of stimulus 6 and 3 in the dendrogram (Fig. 2). Hence, four categories of content types, cluster I, cluster II, cluster III, and cluster IV were classified by all participants. Subsequently, the clusters were named after the combination characteristics according to the clustering results and the participant interviews.

1. Cluster I: Totaling 107 stimuli in this cluster. It accounted for 52.7% of sampled infographics. The common theme of which was various research survey or issue coverage with huge volumes of statistic data. Such as “Facebook vs Twitter”, it made various comparison of the percentage distribution among users background and online activity between these two iconic social medias. The content of infographic tended to be more informative than entertaining. Thus, this cluster was named as “statistical data”.
2. Cluster II: Totaling 21 stimuli in this cluster i.e., 10.3% of sampled infographics. Except for collecting the data, this cluster aimed to offer a proper interpretation from

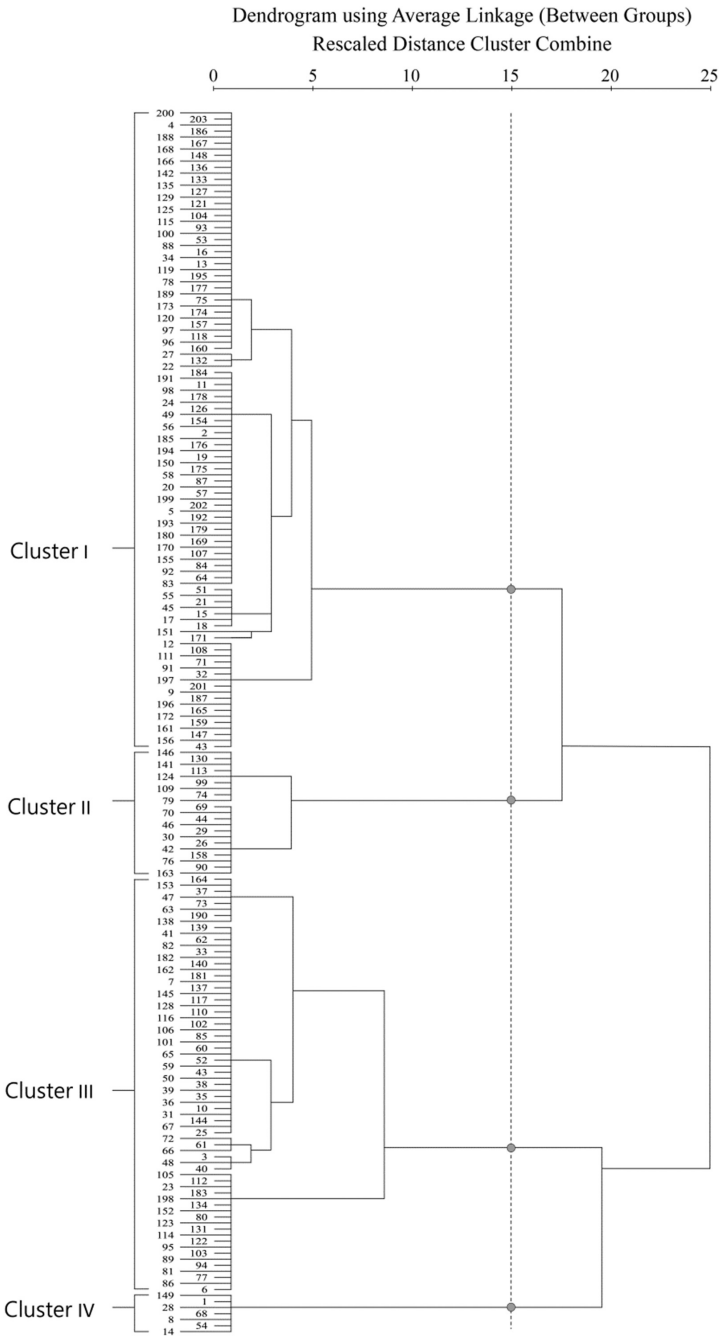

Fig. 2. Dendrogram of content topic

the result of comparisons. Such as "Social vs. Search", it distinguishes the differences between these two online methods measure up on their own. Most people prefer social media over search marketing. However, this infographic told us that combing these two would lead to more powerful results. Thus, this cluster was named as "original insight".

3. Cluster III: Totaling 68 stimuli in this cluster. It took up 33.5% of sampled infographics. The content of this cluster covered the familiar daily topics and social phenomena. Such as "Should I Text Him", it told us that sometimes people's minds and their decision-making skills are just not up to par. Then, this infographic helped us navigate the tricky waters of whether or not we should go ahead and hit send in a funny way. This content of infographic tended to be more entertaining than informative. Thus, this cluster was named as "life issues".
4. Cluster IV: Totaling 7 stimuli in this cluster i.e., 3.4% of sampled infographics. The content of this cluster focused on a series of results for the evolution process of a particular topic. Such as "The subjective timeline of the best gift ever", it reflected on a long history of boy's and girl's amazing holiday gifts - then and now. Thus, this cluster was named as "development progress".

3.2 Cluster Analysis of Appeal Type

The issue of appeal has been explored in the fields of advertising and communication (Laskey et al. 1995; Ju 1996; Lin and Tu 2006), and rational/emotional appeal is generally accepted. Hence, this study classified the appeal type of stimuli based on the distribution of participants' subjective scoring, instead of card sorting assignments task. From the summary of agglomeration schedule in Table 3 and dendrogram in Fig. 3, the assignments was divided into the two clusters, containing 127 and 76 stimuli respectively.

Table 3. Summary of agglomeration schedule of appeal type scoring

Stage	Cluster combined		Coefficients	Difference	Stage cluster first appears		Next stage
	Cluster 1	Cluster 2			Cluster 1	Cluster 2	
1	12	198	0	0	0	0	4
7	19	37	0	0	0	0	38
201	1	3	3.152	12.505*	199	197	202

Subsequently, Table 4 showed that the means of cluster with 127 stimuli and that with 76 stimuli were 6.126 and 2.329, revealing that the former cluster was stimuli of rational appeal, and the latter cluster belonged to emotional appeal. Hence, infographic adopted rational appeal (62.6%) more than emotional appeal (37.4%).

Additionally, a t-test was performed to examine if a differences between the scoring of rational appeal (6.126) and that of emotional appeal (2.329). From the summary in

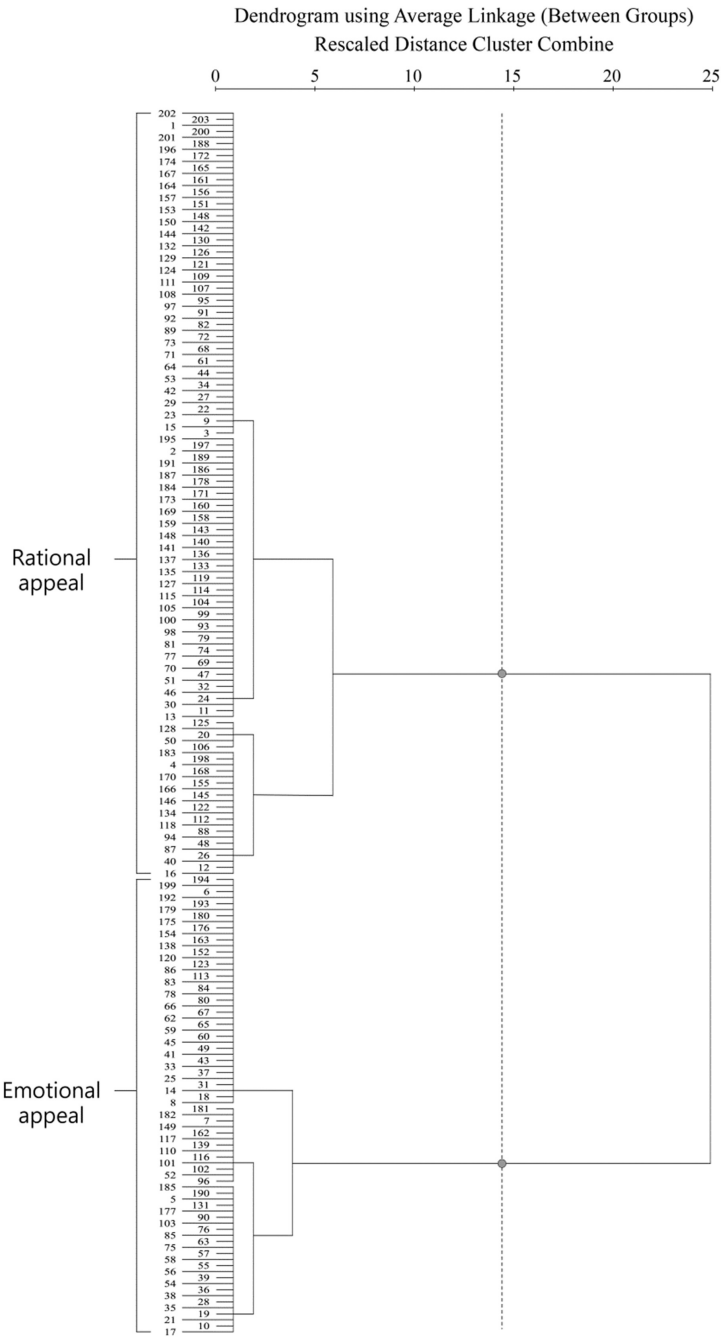

Fig. 3. Dendrogram of appeal type

Table 4. Summary of descriptive statistics of appeal type

Appeal Type	Counts	Mean	SD.	Percentage
Rational appeal	127	6.126	.823	62.561%
Emotional appeal	76	2.329	.750	37.438%

Table 5. Summary of t-test of appeal type

	95% Confidence interval of the difference		t	df	Sig.
	Lower	Upper			
Appeal score	.017	.027	8.376	29	.000

Table 5, a significant difference existed ($t = 8.376$, $p < .05$), offering a support for the validly of classification result.

3.3 Association Analysis Between Content Topic and Appeal Type

According the previous classification results of content topic and appeal type, the assignments of stimuli were integrated in Table 6. Then this study conducted a chi-square test to evaluate association between the two variables. From the test summary in Table 7, it showed that an association significantly existed ($\chi 2 = 25.883$, $p = .000$).

Table 6. Cross tab of appeal type and content topic

		Appeal type		Total
		Rational	Emotional	
Content topic	Life issues	31	37	68
	Statistical data	24	83	107
	Original insight	12	9	21
	Development progress	1	6	7
Total		68	135	203

Table 7. Chi-square tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-square	25.883[a]	3	.000
Likelihood ratio	26.394	3	.000
Linear-by-Linear association	.506	1	.477
N of valid cases	203		

The two types of rational appeals and emotional appeals were 62.6% and 37.4%, revealing that both obtain a considerable proportion. Further incorporating the factor of content topic into account, it was found that significant difference existed among the percentages of content topics by appeal types. From the statistical results in Table 8, it signified that rational appeal was adopted usually by statistical data (77.6%) of content topic, and emotional appeal was used usually with development progress (85.7%) and life issues (54.4%).

Table 8. Content topic by appeal type

			content topic				total
			life issues	statistical data	original insight	development progress	
appeal type	rational	Count	31_a	83_b	$12_{a,b}$	1_a	127
		% within content	45.6%	77.6%	57.1%	14.3%	62.6%
		% within appeal	24.4%	65.4%	9.4%	0.8%	100.0%
		Residual	-11.5	16.1	-1.1	-3.4	
	emotional	Count	37_a	24_b	$9_{a,b}$	6_a	76
		% within content	54.4%	22.4%	42.9%	85.7%	37.4%
		% within appeal	48.7%	31.6%	11.8%	7.9%	100.0%
		Residual	11.5	-16.1	1.1	3.4	
total		Count	68	107	21	7	203
		% within content	100.0%	100.0%	100.0%	100.0%	100.0%
		% within appeal	33.5%	52.7%	10.3%	3.4%	100.0%

4 Discussion and Conclusions

4.1 Content Topic and Appeal Type of Infographic

Based on survey of current status and statistical analysis on popular infographics, this study classifies the four categories of content topic: life issues, statistical data, original insight, and development progress.

According to the point that the theme of message property has the two aspects of informativeness and entertainment (Scharl et al. 2005; Steinbock 2007), the four categories of content topic can be reorganized as Fig. 4(a). It clearly reveals that proportion of informative message (black area) in the content topic of infographic is larger than that of entertaining message (gray area). Moreover, the survey of appeal type is depicted in Fig. 4(b), showing that rational appeal adopted by infographics is more than emotional appeal.

In order to clearly explain the effects between the content topic and appeal type, this study rearranges the association results in Table 9. Kotler (1991) indicated that

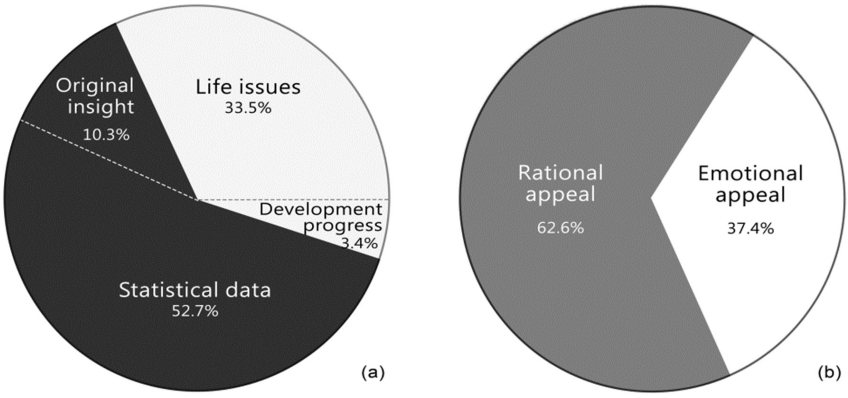

Fig. 4. Pie charts of content topic and appeal type

Table 9. Summary of association between content topic and appeal type

		content topic（informative）		content topic（entertaining）	
		statistical data	original insight	life issues	development progress
appeal type	rational	●	○		
	emotional		○	●	●

message in rational appeal usually conveys in a way of logic, reason, and benefit. It corresponds with the survey results that statistical data of content type has a high ratio in informative theme of infographics.

Furthermore, emotional appeal focuses on the pursuit of personal or social emotional needs (Snyder and DebBono 1985). From the content topic survey and participant interviews, it shows that life issue is usually full of delight and entertainment, and development progress often emphasis the features which is related to potential target group. It provides a possible explanation for the high proportions of these two content topics in emotional appeal.

Lastly, original insight is the only one that does not tend to favor neither rational nor emotional appear among all types of content topic.

5 Conclusions

Infographics offer people visual information in an easy way to consume and share, becoming a viral phenomenon on the internet and social media. Hence, this study conducted a survey on popular infographics using card sorting and cluster analysis for classification. Then an association analysis was performed to examine the interaction between the two factors of “content topic” and “appeal type”. Overall, the findings

could enable designers to enhance users' experience in visual communication, as well as further studies in infographic. The following conclusions were drawn from the results of this study.

1. The content topic was divided into the four categories: "statistical data", "original insight", "life issues", and "development progress".
2. Infographics using "rational appeal" were more than those using "emotional appeal".
3. A significant association existed between content type and appeal type. Rational appeal was usually adopted with the contents of statistical data, and emotional appeal was usually applied in the topics of development progress and life issues.

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