What Do Users Want to See? A Content Preparation Study for Consumer Electronics

Yinni Guo[1], Robert W. Proctor[2], and Gavriel Salvendy[1,3]

[1] School of Industrial Engineering, Purdue University, W. Lafayette, IN, USA 47907
[2] Department of Psychological Science, Purdue University, W. Lafayette, IN, USA 47907
[3] Department of Industrial Engineering, Tsinghua University, Beijing, China 100084
{guo2,salvendy}@purdue.edu, proctor@psych.purdue.edu

Abstract. To investigate what users want to see from consumer electronic devices, a content preparation study was conducted. A questionnaire was constructed based on the results from web site content research and traditional usability studies on consumer electronics, and was completed by 401 Chinese participants. The statistical results reveal that there are nine major factors of cell phone content. Also users of different age and gender have different requirements for cell phone content, especially concerning accessory and multimedia functions. This study suggests guidelines for cell phone designers targeted at the Chinese market, as well as a base for content study of other consumer electronics.

Keywords: Content preparation, factor structure, consumer electronics.

1 Introduction and Literature Review

To assist users' decision making and enhance customer satisfaction, researchers should study not only the question of how to design the interface so that users can operate it easily, but also the question of what information needs to be made available for users to access. The term *content preparation* is used to refer to the study of determining what types of information to convey to the users, what techniques are appropriate to elicit necessary content from customers, and how to classify the information into well-established categories [1].

Three recent studies of content preparation have been conducted by Liao et al. [2], Guo and Salvendy [3], and Savoy and Salvendy [4]. Liao et al. [2] developed and implemented a web-based survey in an attempt to discover the differences in information preferences between U.S. and Chinese online consumers. The survey concluded with seven factors: product return and exchange, online retailer reputation, product cost and performance, manufacturer reputation, product appearance, technology, and product facts. The factor analysis of Guo and Salvendy's [3] study indicated 15 main content factors for Chinese e-business web sites: security content, quality content, service content, appearance description, contact information, aid function, customized function, search function, product specification, purchasing aid, price content, detailed description, comment content, matching product, review content. In another

J.A. Jacko (Ed.): Human-Computer Interaction, Part I, HCII 2009, LNCS 5610, pp.413–420, 2009.

culture-related content preparation study, Savoy and Salvendy [4] found that seven factor captured the survey structure: general product description, member transaction, shipping, secure customer service, company, durability and price.

Comparison of the three studies reveals similar factors of web site content and provides evidence that the quality of content plays an important role in usability. Given the importance of content preparation for web sites, the study of content preparation should be extended to non-web-based products like consumer electronics. Compared to web-based products, consumer electronics are similar in being used to display a large amount of information to the users. However, unlike web-based products, consumer electronics like mobile phones and PDAs impose limitations of small screen size and cumbersome input mechanisms [5]. Therefore, indication about ways to control the devices may be essential in the content structure. We chose cell phones as representative of consumer electronics because nowadays cell phones are being developed as multi-functional devices; therefore, the factor structure of cell-phone content may be applicable to other appliances.

A related study of content for consumer electronics was performed by Caus et al. [6]. They pointed out that reasons for low market penetration of mobile applications included their lack of standardization concerning the handling of information and high technical complexity. Caus et al. proposed that one possible way to reduce the problem of representing and selecting content in mobile Internet use was to only offer users content relevant to their particular situation, through context-aware information processing.

2 Methodology

When the users are using a certain function of the cell phone, they are facing a series of tasks. Therefore the essential issue for cell phone content is what content should be provided so that users can operate the functions easily, and what types of functions are necessary. One way to figure out what content is needed is to ask the customers themselves. The three previous studies [2, 3, 4] validate the efficiency of surveys. Therefore, a questionnaire was developed based on previous content preparation studies, cell phone usability studies [7, 8, 9, 10], multi-media studies on cell phones [6, 11] and observation of current advanced cell phones. Content questions included six major categories: function (18 questions), menu (8 questions), instruction and status (15 questions), file (6 questions), input and search (8 questions), service (4 questions), and phone calls features (5 questions). The questionnaire included these 64 questions and 4 questions asking participants' feelings concerning how much cell phone content would influence their satisfaction, operation efficiency, and effectiveness, as well as whether current cell phone content is enough. There were also seven demographic questions to investigate users' backgrounds. Out of the 68 questions, there are four repeated questions to test internal consistency.

3 Procedure and Participants

The survey was conducted in Xiamen, China, in May 2008. A paper-based questionnaire was used due to distribution convenience. A total of 401 participants filled out

the survey, out of which 375 yielded usable results. Twelve participants did not finish the whole questionnaire, and 14 participants answered the questionnaire with low internal consistency.

42% of the participants were female. The ages of subjects ranged from 18 to 60 years, with 95% of them being under age 40 years. About 96% of the subjects had education higher than an associate college degree. The participants had a diverse range of occupations. Most had experience of using cell phones for 2 years or longer and with 2 or more models. Detailed description of the subjects' demographic information can be found in Table 1.

Table 1. Demographic characteristics of survey participants

	Categories				
Gender	Female		Male		
	158		217		
Education Level	High school	Associate	Undergraduate	Graduate	Others
	6	6	316	47	0
Age	Under 20	20-29	30-39	Over 40	
	33	315	15	12	
Occupation	Manager	Sales	Staff	Engineer	
	28	29	43	68	
	Technician	Teacher	Student	Others	
	22	41	133	11	
Models	0	1	2	>2	
	7	111	137	120	
Years	0-1	2-4	5-8	≥8	
	10	195	123	47	

4 Results and Discussion

4.1 General Results and Factor Analysis

We use a 7-point Likert scale to record users' attitude. The mean answers for each question ranged from 4.05 to 6.22, with standard deviations ranging from 0.93 to 1.73. Some questions yielded extremely high means with low standard deviations, which indicates that these items are considered very important across all participants. These questions are about the main or basic cell phones features like calendar, message status, search by name function, time of a missed call, and missed call times. On the other hand, some items like sequential shooting camera, mobile televisions, dual time zone function, and animation of power on/off had low means and high standard deviations. This result shows that participants' preferences concerning accessory functions differ a lot, probably due to different backgrounds.

The survey also reveals that participants agree that quality of cell-phone content would influence their satisfaction (mean rating, $M = 5.56$), as well as their operation efficiency ($M = 5.23$). There was no agreement on "current content is enough" ($M = 4.46$; $SD = 1.73$), which indicates that for many current cell-phone models, but not all, the necessary contents are not all included.

The survey showed an acceptable overall internal consistency of 0.82. To get the hidden structure of information content, maximum likelihood factor analysis with varimax and promax rotations was conducted. By examining the scree plot and eigenvalues, we found that 9 factors would explain 85.54% of the total variance. Under each factor, items with loadings lower than 0.50 were considered insignificant and eliminated. The factors were named according to the loading questions. Factor 1 includes content items of "current input method", "the input 'pinyin' letters", "what content has been input", "search by name" and "search by initial". Therefore it could be concluded as factor about "Input and search". Factor 2 covers questions about "number of each function", "name of each function", "all options of each function on any menu", "scroll bar" and "cursor", which are all related to assistance to functions. Therefore, Factor 2 is named as "Functions". Items under Factor 3 are all related to the indication of keys or functions, like indication of "back to previous menu", "confirm key" and "which keys are in use". Therefore Factor 3 is named as "Operation". Factor 4 includes the three most widely used multimedia functions (digital camera, sequential shooting camera, video camera), and is named as "Multimedia function". Factor 5 covers items of "file size", "photo size", "file properties" and "storage". It could be named as "Stored files" since all four items are related to cell phone storage space and stored file attributes. Questions loaded under Factor 6 are all about phone calls like "miss call times", "time of a miss call" and "length of each call". It could be named as "Phone calls". Factor 7 could be named as "Help and service" because the loaded questions are about how to get more information about signal carrier and manufacturer, as well as help information of cell phone functions. Factor 8 covers a large range of questions from reminding icons to emergency key and could be considered as "Accessorial functions". Factor 9 can be concluded as "Message" since it contains two items "icon of message box status" and "icon of voice mail status". Of the original 64 questions of cell-phone content, 27 items did not load on a factor. Therefore the questionnaire could be simplified for future use.

Out of these nine factors, four factors (Factor 4, 6, 8, 9) are about specific cell-phone functions. These factors and the items covered could be applied to the design of cell-phone content. The other five factors are related to general functions and operation. These factors are universal and could be applied to the content design of most consumer electronics. For instance, Factor 5 could be used for devices that could store files, like music player, digital camera, PDA, GPS; Factor 2, Factor 3 and Factor 7 need to be applied for every information appliance.

4.2 Analysis of Users of Different Backgrounds

The survey included seven demographic questions to classify participants with different backgrounds. By checking the difference, we could give guidelines of whether different designs should be considered for different user groups. Duncan's multiple range test has been taken to compare all pairs of means, with alpha level of 0.05 set for statistical significance. Difference of means over 10% is considered as a practical significant difference; and items revealed to be practical significant different are listed in Table 2. For the comparison between females and males, 23 items show statistically significant differences. However, only one item "Message of break out incident" shows a practical difference. Females tends to agree more than males on getting

message when there is any break out incident like explosion, hurricane, or earthquake. This is probably because women are more averse to risk taking [12] and perceive greater danger than men [13].

The comparison of three age groups showed many differences. Although most of the subjects were no more than 40 years of age, differences still exist among participants of different age ranges. Thirty questions show statistically significant differences between age groups of "under 23 years old", "23 to 29 years old" and "above 29 years old". Twelve questions show practical significant differences, while 11 of them show decrease on mean as age increases (Fig. 1). These questions are all about whether a certain accessorial function is necessary, like mp3 player, instant message, memo, etc. This result can be concluded as the older users do not want accessorial functions as much as younger users do.

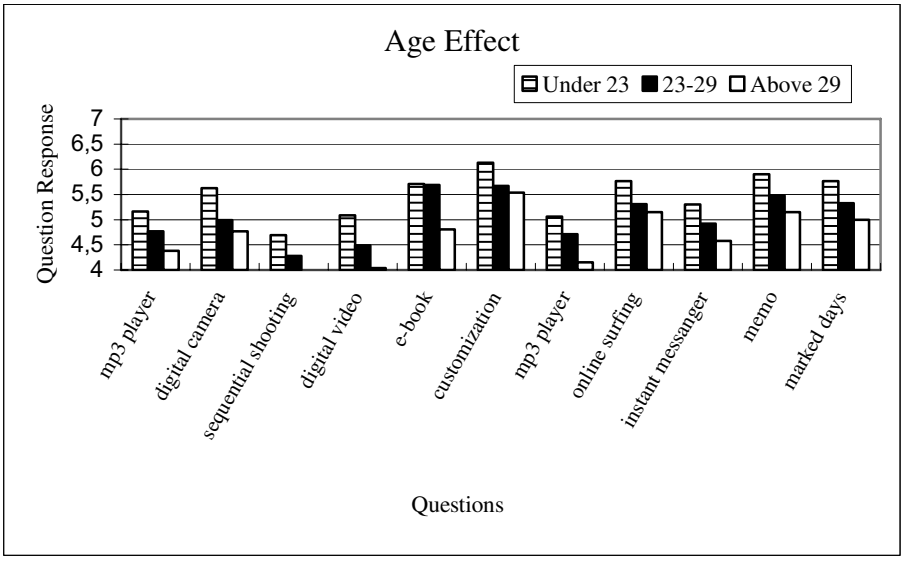

Fig. 1. Mean response for different product features as a function of age

The education level of participants varies from associate degree to Ph.D. degree. However, there are much more undergraduate degree level subjects than associate degree level subjects. Therefore, we decided to compare only two groups, undergraduate degree level and graduate degree level. By checking the results we can see that there are 8 items showing statistical significance, 6 of which show practical significance. Similar to what we have found in the age comparison, these 6 items are questions about whether a certain multimedia or accessorial function is necessary. The results suggest that participants with higher degrees would pay less attention to these features. However, this tendency might also interact with the age factor since people with graduate degrees tend to be older than those with undergraduate degrees.

The demographic table shows that the numbers of sales personnel, technicians and managers are not comparable to the number of students. Therefore, we decided to combine participants with jobs and compare them with the students. The results reveal

Table 2. Practical significant differences between subjects of different backgrounds

Questions	Female	Male	%	P
Message of break out incident	6.28	5.56	12.95	<0.0001

Questions	< 23	23 to 29	> 30	%	P
Mp 3 function	5.16	4.77	4.38	17.81	0.0041
Digital camera function	5.63	4.99	4.77	18.03	<0.0001
Sequential shooting	4.69	4.28	4.00	17.25	0.0083
Video camera	5.09	4.49	4.04	25.99	<0.0001
E-book function	5.71	5.69	4.81	18.71	0.0022
Customization function	6.13	5.67	5.54	10.65	<0.0001
Mp3 function	5.06	4.71	4.15	21.93	0.0032
Online surfing	5.77	5.31	5.15	12.04	0.0011
Instant messenger	5.30	4.92	4.58	15.72	0.0037
Indication of "back to previous menu"	5.56	5.12	5.65	10.35	0.0053
Icon of "memo" status	5.90	5.48	5.15	14.56	0.0002
Icon to remind marked days	5.77	5.33	5.00	15.40	0.0001

Questions	Undergraduate	Graduate	%	P
Digital camera function	5.51	4.81	14.55	0.0011
Video camera	4.96	4.38	13.24	0.0111
Cell phone game	5.25	4.74	10.76	0.0185
Customization function	6.05	5.49	10.20	0.0003
Mp3 function	5.02	4.28	17.29	0.0012
Instant messenger	5.22	4.70	11.06	0.0107

Questions	Non-student	Student	%	P
Video camera	4.47	4.93	10.29	0.0467
E-book function	5.09	5.71	12.18	0.0026
Customization function	5.37	6.04	12.48	<0.0001
Online surfing	5.00	5.68	13.60	0.0005
Instant messenger	4.63	5.22	12.74	0.0048
Icon of "memo" status	5.16	5.82	12.79	0.0003
Icon to remind marked days	5.09	5.67	11.39	0.0021

	Number of models					
Questions	0	1	2	> 2	%	P
Animation of power on/off	4.29	4.76	4.39	4.23	12.5	0.0320

	Years of using				
Questions	0-2	3-6	> 6	%	P
Video camera	5.17	4.92	4.49	15.14	0.0256
Mp3 function	5.54	4.93	4.43	25.06	0.0003
Indication of "confirm" key	5.00	5.59	5.46	11.80	0.0003
Animation of power on/off	5.00	4.38	4.35	14.94	0.0146

	Usability's importance				
Questions	High	Median	Low	%	P
Digital camera function	5.29	5.31	5.88	11.15	0.0042
Number of each function	5.27	4.97	4.76	10.71	0.0063

that there are 9 items that show statistically significant differences, and 7 of them are practical significant. Like the difference between undergraduate and graduate degree holders, the 7 items are all about accessorial functions. Non-student participants would not pay as much attention to these functions as students. This result might also interact with the age factor since people with jobs tend to be older than students.

There is only one item showing significant difference between participants with different cell phone model experience. Participants who have used more cell phone models prefer less animation of power on/off than less experienced users. But this trend does not apply to participants with no experience at all. Compared to other effects like age, education level and job category, the effect of model experience is much weaker.

On the contrary, how many years that the participant has used cell phones shows more significant differences. Out of 11 statistically significant items, 4 of them are practical significant different. Experienced users were prone to place less attention to accessorial functions. This might also interact with the age factor since people have been used cell phone longer tend to be older.

The comparison of participants that hold different opinions about cell phone usability shows six items as significantly different, and two of them are slightly practical significant. Participants who consider usability as "very important" or "median" do not think that the digital camera function is as important as participants who consider usability to be "not important". But when talking about "number of each function", the result is the opposite. It might be because "number of each function" is a way to support cell phone usability.

After finalizing the factor structure, we compared participants with different backgrounds on the nine factors. Results from a MANOVA showed that only cell phone model experience has no influence on any factor. The age effect and usability effect would cause most differences. For all effects, the differences always include the need of information of accessorial functions or information of multimedia function.

By checking the main effect of demographic characteristics, we found that Age and Gender are the two major characteristics, each of which shows significant on 27 and 20 items ($p < 0.05$). All the other characteristics have less than 7 significant items. Therefore, we can conclude that designers should make different models for users of different target age groups and target genders. For the current market, designs for different genders are more common than designs for different age groups. Older users complain that they cannot find cell phones that they can use [14].

5 Conclusions and Guidelines

There are basically four conclusions from the above analysis. First, content with higher quality will benefit customer satisfaction, and there is room for current cell phones to improve their content. Second, there are different needs of content for users with different backgrounds, especially for different ages. Younger users, especially students, rely a lot on multimedia functions and content, while older users or industrial populations do not consider them important. Designers need to take this into consideration when they are designing cell phone content. For example, offering the elder and business users cell phones with stable and high quality phone call functions, easy accessed phone book and easy input keypad is more important than providing the most advanced multimedia functions. Thirdly, 27 questions in the original questionnaire did not load on any of the factors. Therefore, the questionnaire can be simplified for future use. Fourth, information about input and search shows importance on how much variance it explains and the factor mean. This factor is essential for the Chinese

population because it is more difficult to input Chinese using the small cell phone panel, though text messaging is more widely used in China than in the U.S.

Compared to existing studies of cell phone interface and cell phone usability, this study complements the lack of consideration given to content and content structure [7, 8, 9, 10]. Compared to the study of Caus et al. [6], which discussed about context-adaptive information for cell phones, this study provides a straightforward structure of the necessary information.

References

1. Proctor, R.W., Vu, K., Salvendy, G.: Content Preparation and Management for Web Design: Eliciting, Structuring, Searching, and Displaying Information. International Journal of Human-Computer Interaction 14, 25–92 (2002)
2. Liao, H., Proctor, R.W., Salvendy, G.: Chinese and U.S. Online Consumers' Preferences for Content of E-commerce Web Sites: a survey. Theoretical Issues in Ergonomics Science 10, 19–42 (2009)
3. Guo, Y., Salvendy, G.: Factor Structure of Content Preparation for E-business Web Sites. Behaviour and Information Technology (in press)
4. Savoy, A., Salvendy, G.: Foundations of Content Preparation for the Web. Theoretical Issues in Ergonomics Science 9, 501–521 (2008)
5. Venkatesh, V., Ramesh, V., Massey, A.P.: Understanding Usability in Mobile Commerce. Commun. ACM 46, 53–56 (2003)
6. Caus, T., Christmann, S., Hagenhoff, S.: Hydra – An Application Framework for the Development of Context-Aware Mobile Services. In: Business Information Systems, vol. 7, part 14, pp. 471–481. Springer, Heidelberg (2008)
7. Simth-Jackson, T.L., Nussbaum, M.A., Mooney, A.M.: Accessible Cell Phone Design: Development and Application of a Needs Analysis Framework. Disability and Rehabilitation 25, 549–560 (2003)
8. Kaikkonen, A., KekÄlÄinen, A., Cankar, M., Kallio, T., Kankainen, A.: Usability Testing of Mobile Applications: a Comparison between Laboratory and Field Testing. Journal of Usability Studies 1, 4–17 (2005)
9. Zhang, D., Adipat, B.: Challenges, Methodologies, and Issues in the Usability Testing of Mobile Applications. International Journal of Human-Computer Interaction 18, 293–308 (2005)
10. Ji, Y.G., Park, J.H., Lee, C., Yun, M.H.: A Usability Checklist for the Usability Evaluation of Mobile Phone User Interface. International Journal of Human-Computer Interaction 20, 207–231 (2006)
11. Miyauchi, K., Sugahara, T., Oda, H.: Relax or Study? A Qualitative User Study on the Usage of Mobile TV and Video. In: Changing Television Environments, pp. 128–132. Springer, Heidelberg (2008)
12. Byrnes, J., Miller, D., Schafer, W.: Gender Differences In Risk Taking: A Meta-Analysis. Psychological Bulletin 125, 367–383 (1999)
13. Lagrange, R., Ferraro, K.: Assessing Age and Gender Differences in Perceived Risk And Fear Of Crime. Criminology 27, 697–720 (2006)
14. Guo, Y., Proctor, R.W., Salvendy, G.: Development and Validation of Axiomatic Evaluation Method (working paper)