Research on Discussion of Gender Difference in Preference for Smart Watches Based on Fuzzy Analytic Hierarchy Process

Tianxiong Wang(✉) and Feng Shan

School of Art, Guizhou Normal University, No. 116, Baoshan North Road, Yunyan District, Guiyang 550001, China
ll92913346@qq.com, 80780162@qq.com

Abstract. As wearable devices have been intelligentized in recent years, many high-teach companies launch smart watches successively. These companies constantly upgrade shapes and functions of smart watches. However, market performances of some products are not up to the expected standard, since smart watches are in the leading-in period of product life cycle and the market demand remains unclear. Furthermore, because different consumer groups have different consumer psychologies and behaviors, they show various preferences for functions of smart watches. For instance, male group tends to be more rational and regular in consumer behaviors, while female group is more sensitive with active thinking and strong initiative in consumer behaviors. Moreover, female group prefers to pursue fashion and novelty, purchase some new products and try new life. As a result, how to locate developments of smart watches in light of needs of different users is an important research topic. According to the questionnaire data, this research adopts Fuzzy Analytic Hierarchy Process (FAHP) to explore the differences of consumer psychologies and behaviors of customers in product preferences, concluding the determinant attributes for attracting consumers to buy products. Compared with traditional Analytic Hierarchy Process (AHP), FAHP combines AHP and fuzzy theory. Ambiguous problem assessments must use the concept of fuzzy function in FAHP to calculate fuzzy weights. This research adopts questionnaire survey to handle research questions in hierarchical analyses. Similarity aggregation method is utilized to integrate opinions of research objects. Then, FAHP is used to figure out importance degrees of all hierarchies, analyzing the differences of the two groups in preferences for functions of smart watches. First of all, this research collects opinions of experts and experienced product designers through surveying users of smart watches. In addition, various kinds of evaluation criteria are selected. The representative five criteria and thirteen sub-criteria are arranged through classification. The five criteria are battery time, interaction, communication, security and APP development. The thirteen sub-criteria are voice, touch, physical, auxiliary communication, independent communication, waterproof, theftproof, time management, geographic information, intelligent life, sports health, sociality and battery time. After confirming the hierarchical structure established by five criteria and thirteen sub-criteria, this research adopts paired comparison method to design the questionnaire. Moreover, this research sets up paired matrix table of questionnaire data in accordance with the defined evaluation values of fuzzy linguistic. Besides, this research integrates opinions of research

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objects through similarity aggregation method, calculating fuzzy weights for obtaining eigenvectors and eigenvalues. Eventually, this research conducts criteria ranking of all data from assessment criteria and sub-criteria. That is how to infer the differences of different gender consumers in preferences for functions of smart watches. According to the methods and results of this research which can be aimed at different target populations, development strategies of smart watches are proposed respectively and recommendation of product function combination is presented in light of different target markets.

Keywords: Fuzzy Analytic Hierarchy Process (FAHP) · User preference · User psychology · User behavior · Product development

1 Introduction

In recent years, wearable intelligent products on the market has been developing rapidly, which mainly refers to the integrated use of various types of identification, sensing, connectivity and cloud services interaction and storage technology, instead of handheld devices or other equipment, to realize the new daily wearable device of user interaction, entertainment, monitoring of the human body and other functions. In the wearable product design, wearable technology is being integrated into wearable devices, to achieve the science and technology of functions, which is a key application of wearable devices, including embedded technology, identification technology (such as voice, gestures, and eye), sensor technology, connection technology, flexible display technology and so on. The data of iiMedia Research shows that a variety of equipment shipments reached 2 million 300 thousand in the Chinese wearable device market in 2012, and the market scale reached 610 million yuan. It is expected that shipments in Chinese wearable device market in 2015 would reach more than 40 million, and the market scale would reach 11 billion 490 million yuan. IiMedia Research believe that Chinese wearable device market will get rapid growth and become the core of the global wearable device market with the gradual rise of the global wearable device market. Different wearable devices with forms will also enter into people's lives from all aspects, so wearable devices will become the market focus.

With the development of wearable smart products, smart watches undoubtedly become the focus. Specifically speaking, the smart watch has a smart watch system, equipped with a smart phone system to be connected to the network. It can achieve multiple functions, and can synchronize the phone's text messages, e-mail, photos, and music, etc. At the same time, with the development of mobile technology, watches are paid attention to increasing the function of mobile. For example, watch can be used to show time only in the past. Today, it also can through intelligent mobile phone and home network connected to the Internet, display the information, Twitter, news, weather information and other content. This smart watch is becoming a new type, such as Samsung Galaxy Gear 2 - smart watch will make voice control, camera, telephone, intelligent perception, the local MP3 player and infrared remote control widely used in this product. In addition, the Gear2 can use a lot of new advanced sensors to track your heart rate when you are exercising, recording the number of steps you take every day, in order to effectively measure your motion state. Voice input is also the highlight of

this product, as it allows you to record and answer messages, setting the schedule, open and close, as well as some other basic tasks. Obviously, this smart watch can give users more intelligent user experiences.

With the development of technology, product features have become increasingly complex, which conflict with human's simplicity needs when they use the product. So people become to concern the usability of the product. Availability has become an indispensable part for consumers to buy products (Mack and Sharples 2009). Furthermore, when users use smart watches, there will be obstacles, slow operation and easy mistake-making, which puts forward higher requirements for product availability. Kansei Engineering, a new products design technology concerning about consumer emotional experience or sensory needs, has been widely used in product availability studies in recent years. Such as: Han et al. (2001) is available for different emotional definition and dimension of division based on user satisfaction of consumer electronics products; Huang et al. (2013) proposed the concept of appearance availability, and she thought the appearance of the product is an important attribute characteristics which can bring certain impacts to the availability of product. Camargo et al. (2014) proposed a method that based on the study of semantic attributes of products and the analysis of usability test data after analyzing the relationship of product semantic attributes by integrating user perception. It can be seen that the use of Kansei Engineering for quantitative research on product usability can enable designer more effective to find the availability of the main and objective factors, then the design can be improved.

2 Literature Review

2.1 Outline of Analytic Hierarchy Process

Analytic hierarchy process (AHP), developed by Thomas L. Saaty of the University of Pittsburgh in 1971, is applicable for decision-making problems with uncertainties and multiple evaluation criteria.

AHP is a systematic approach for complex problems, which features in constructing the complicated decision-making problem into a type of hierarchical structure. Thus the complex relationship of the impact factors could be systematically connected and the assessment items are decomposed from the high-level assessment criteria to the lower-level one until the lowest level of the candidate program, and through a comprehensive quantitative assessment to obtain objective decision-making results (Saaty 1980).

In summary, the purpose of AHP is to deal the problem with uncertain factors under multiple evaluation criterion and reduce the burden of thinking through systematic dismantling and pairwise comparison to quantify the results; Then re-integration of quantitative data to obtain weight to help decision-makers determine the merits of the strategy and reduce the risk of strategic errors. According to the Saaty (1980) study, the field of application of the Analytical Hierarchy Process approach includes decision priorities, alternatives plan, selection of best practices, determination of requirements, resource allocation, forecasting result or risk assessment, performance measurement, system design, ensuring system stability, optimization, planning, conflict resolution and other 12 categories of problems.

Cheng and Mon (1994) pointed out that the AHP method has five missing project in the decision-making assessment: 1. AHP method is mainly used in clear (non-fuzzy) decision-making. 2. The AHP method uses an asymmetric scale to measure the problem. 3. The AHP method can not cover the uncertainty of human cognition. 4. The ranking of the AHP method is rather unclear. 5. Decision-makers subjective judgments, choices and preferences which have a great impact to the selection results of AHP method; then, the judge is wrong, the decision-making results are not correct. Although the AHP method is simple, easy to solve and can deal with qualitative and quantitative properties of the advantages simultaneously, but it's assessment scale is the degree of human perception to things, which has been divided into nine scales to be measured. So it can't fully cover subjectivity, fuzzy and uncertain factors of human cognition. For example, when the problem is complex, sensitive, incomplete information, decision-making program is not sufficient to fully reflect the decision-making environment, or expert knowledge of the program is not comprehensive enough to determine the human judgment with a variety of possibilities at this time, unable to point out that a certain value in comparing two important degree of judgment, just only description by language. Fuzzy Hierarchy Analysis (FAHP) can be used to transform fuzzy language expression into fuzzy scale data, which is more suitable for the fuzziness of semantic judgments in real environment (Zheng Jing Vulgar 2003).

2.2 Outline of Fuzzy Analytic Hierarchy Process

The AHP of Saaty is easily operated and widely used in multi-criteria decision-making. However, the human's fuzzy knowledge about scale, which AHP can not express, is the biggest disadvantage. So when the AHP method is put forward, it causes numerous scholars discussion and also appeared a lot of improved methods. Van Laarhoven and Pedrycz (1983) introduced the concept of fuzzy number into the pairwise comparison matrix of AHP in 1983, and developed the Fuzzy Analytic Hierarchy Process (FAHP) to solve the subjective, fuzzy and inaccurate problems in traditional Analytic Hierarchy Process.

Buckley (1985) combines the fuzzy set theory and the hierarchical analysis method to transform the expert opinion to the fuzzy positive and reciprocal value matrix by using the trapezoidal fuzzy number. Then the fuzzy weight is obtained through the geometric mean that the alternatives about the fuzzy weights are calculated by cascade connection. Finally, use the weight of each alternative fuzzy membership function graphics and figure out the priority of the program. Although the method is more stringent, the calculation is very complicated.

Zhang Meijuan (2003) pointed out that the real environment is a fuzzy environment, in view of human's uncertain thinking characteristics, so the Analytic Hierarchy Process is expanded to the fuzzy environment. The fuzzy hierarchy analysis can be constructed on the fuzzy Decision-making problem to deal with effectively and it can make up for the Analytic Hierarchy Process disadvantage of not solving the problem that it lack of fuzziness. Wei et al. (2005) used fuzzy complementary judgment matrix to replace Van Laarhoven and Pedrycz used forward and backward value matrix about FAHP method

in the study of supplier selection in enterprise logistics outsourcing which can avoid the asymmetry of measurement scale and has the advantage with being easy to use.

In summary, scholars have pointed out that we must import the concept of fuzzy in the complexity environment when AHP is used to assess the weight because human thinking is so uncertain that subjective cognition or semantic scale asymmetry problem often affect the decision-making results. In the application of FAHP, the decision-making factors of pairwise comparison are set in five groups and six groups, and the fuzzy semantic comparison table proposed is used to reduce the evaluation scale by Chen and Hwang (1992) which is in accordance with the habit of the questionnaire fillers. The selected questionnaire will be converted into triangular fuzzy numbers and substituted into the fuzzy complementary judgment matrix which is different from the general inverted value matrix. This method can solve the problem of AHP (Non-fuzzy) decision to make on the scale of asymmetric measurement of things and human knowledge of uncertainty and other issues. In summary, this study uses Fuzzy Analytic Hierarchy Process to calculate the importance of each level to analyze the different functional preferences degree of men and women in the smart watch. First of all, through the smart watch user research and the views collection of experts and designers, filter out the evaluation criteria and sort out the representative criteria and sub-criteria. After determining the criteria to establish the hierarchical structure by means of the two paired criterion comparison method to design the questionnaire, and then definition evaluation values base on fuzzy semantic. The questionnaire data is built into the matrix table, then the fuzzy weight value is calculated to get the eigenvector and the eigenvalue. Finally, the evaluation criteria and the sub-criterion are used to calculate the questionnaire data which could be sorted. This paper deduces the difference between male and female consumers in the functional preference of smart watches.

3 Use Fuzzy AHP to Extract Customer Preferences Factors on the Core Attributes

3.1 Method of Fuzzy AHP

AHP (Analytic Hierarchy Process) was originally put forward by Saaty in the early 1970s to solve the problem of allocating scarce resources in the military. In order to adapt to the linguistic features of human judgment, the concept of fuzzy is integrated into AHP to measure the core attributes of smart watches and the relative importance of relevant degree (customer preference). In general, fuzzy AHP consists of the following steps:

Firstly, through the research on users of smart watches and opinions collected from experts and experienced product designers, select the criteria of evaluating and sort out 5 representative criteria and 13 sub-criteria by classification. These criteria consist of five criteria including battery time, way of interacting, communications, security, development of APP and 13 sub-criteria including speech, touch, physic, auxiliary communication, independent communication, waterproof, theftproof, time management, geographic information, smart life, sports health, sociality and battery time. After deciding the criteria and sub-criteria, compare 4 criteria with each other, and then compare 12 sub-criteria in pairs.

Secondly, collect judgment opinions from different experts. If the evaluator S evaluates m core attributes, and the expert k makes a pairwise comparison by fuzzy scale, the relative importance between Ci and Cj is shown in the following fuzzy matrix (Table 1):

Table 1. Random index used by fuzzy AHP

The sequence of matrices (standard number)							
n	2	3	4	5	6	7	8
RI	0	0.58	0.90	1.12	1.24	1.32	1.41

$$S_k = \begin{bmatrix} \tilde{b}_{11k} & \tilde{b}_{12k} & \cdots & \tilde{b}_{1mk} \\ \tilde{b}_{21k} & \tilde{b}_{22k} & \cdots & \tilde{b}_{2mk} \\ \vdots & \vdots & \vdots & \vdots \\ \tilde{b}_{m1k} & \tilde{b}_{m2k} & \cdots & \tilde{b}_{mmk} \end{bmatrix} \quad i = 1, 2, \cdots m,$$
$$j = 1, 2 \cdots m, \; k = 1, 2, \cdots S,$$

$\tilde{b}_{ijk}$ represents the fuzzy preference between C_I and C_J. This preference is evaluated by the evaluator K. And then the experts' decision are aggregated by eqs, as shown in the formula.

$$\tilde{b}_{ij} = (L_{ij}, M_{ij}, U_{ij})\tilde{b}_{ji} = \tilde{b}_{ij}^{-1} = \left(\frac{1}{U_{ij}}, \frac{1}{M_{ij}}, \frac{1}{L_{ij}}\right)$$
$$L_{ij} = \min_k(\tilde{b}_{ijk}), M_{ij} = \underset{k}{median}(\tilde{b}_{ijk}), U_{ij} = \max_k(\tilde{b}_{ijk})$$
$$b_{ij} = \left(\frac{L_{ij} + M_{ij} + U_{ij}}{3}\right)$$

$\tilde{b}_{ij}$ represents an aggregated fuzzy number, but b_{ij} represents the defuzzification fragility of the usage of "Regional Center" scheme.

Thirdly, calculate the largest eigenvalues and their corresponding eigenvectors in order to estimate the weight of the m criterion:

$$A = \begin{bmatrix} b_{11} & b_{12} & \cdots & b_{1m} \\ b_{21} & b_{22} & \cdots & b_{2m} \\ \vdots & \vdots & \vdots & \vdots \\ b_{m1} & b_{m2} & \cdots & b_{mm} \end{bmatrix}$$
$$AW = \lambda_{max} W$$

Among them A is the m × m fragility matrix of m attributes, γ_{max} is the maximum eigenvalue of matrix A, and W is the corresponding eigenvector. In this study, eigenvectors are considered as customer preferences (importance weights).

Finally, check the consistency of the matrix. The transport property means if C1 is better than C2 and C2 is better than C3, then C1 is better than C3. The consistency index (CI) and the consistency ratio (CR) shown below are used to determine the consistency of the quality of decision:

$$CI = \frac{\lambda_{max} - n}{n - 1},$$
$$CR = \frac{CI}{RI},$$

Among them CI represents a index of inconsistency (a value closer to zero represents greater consistency) and RI is a random index. If the value of CR exceeds 0.1, the decision-making process is considered to be inconsistent. Therefore, the evaluators need to revise their evaluation viewpoints. Finally, the weighted value reflects the degree of influence and importance of the perceptual evaluation index on the smart watches, and analyzes the preference characteristics of the smart watches by gender differences.

3.2 Process of Investigation

Taking the smart watches as evaluation object, 10 types of common smart watches on the market are selected. And some users are interviewed. Among them 30 people are asked to answer the questionnaire, including 15 males and 15 females. Those people include experienced smart watch users, researchers and scholars engaged in product design, and people who are familiar with smart watch, such as shopping guides. They have been asked to mark the product equative index after finishing the questionaire. In addition, some design major students are also invited to take the test. There are two main reasons for selecting this group as subjects: First, the group is a fashion group and they use the smart watches in high-frequency so they have the ability to complete the requirement test for all tasks; Second, they are sensitive to appearance availability and perceived usability of smart watches than the average person. So that they are scoring has a certain degree of distinction. The task test includes five criteria, which are battery time, interaction, communication, security and APP development, and 13 sub criterias, which are voice, touch, physical, auxiliary communication, independent communication, waterproof, theftproof, time management, geographic information, intelligent life, sports health, sociality and battery time. The evaluation grades were 1–9 grade, taking the efficiency into consideration of the research, participants can just tick the corresponding number of criteria in the questionnaire while marking, which are easily operated so that this marking process can be widely accepted by the users.

Ask the subjects of the interview to compare the functional indicators of the first layer of products with each other, which are interaction and communication, interaction and security, interaction and development of APP, interaction and battery time,

communications and security, communication and development of APP, communication and battery time, security and development of APP, security and battery time, development of APP and battery time, as shown in Table 2. For example, as for interaction and communication, choosing 1 means they are both important, and tick in the corresponding direction of the preferred function. Choosing one of 2, 3 and 4 means slightly important. Choosing one of 4, 5 and 6 means more important. Choosing one of 7, 8 and 9 means very important. And the number 23456789 is the degree of importance. The larger the number, the more important is the function. Then we ask the subjects to fill in the comparison table of the second layer function. The comparison of the second layer function is the detailed classification for indicators of the first layer, so there are four second layer function comparison table in total. For example, way of interacting is divided into three categories including speech, touch and physic. The mutual comparison among these three types is the second layer comparison of the interactive function. The users can select the appropriate level of numbers. Finally, ask the subjects to evaluate the second layer function of smart watches, as is shown in Tables 3, 4, 5 and 6.

Table 2. The first layer function comparison of smart watch

	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	
Interaction																		Communication
Interaction																		Security
Interaction																		Development of APP
Interaction																		Battery time
Communication																		Security
Communication																		Development of APP
Communication																		Battery time
Security																		Development of APP
Security																		Battery time
Development of APP																		Battery time

Table 3. The comparison of the second layer security feature index of smart watch

	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	
Waterproof																		Theftproof

Table 4. The comparison of the second layer communication feature index of smart watch

	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	
Auxiliary communication																		Independent communication

Table 5. The comparison of the second layer interaction feature index of smart watch

	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	
Speech																		Touch
Speech																		Physic
Touch																		Physic

Table 6. The comparison of the second layer development of APP feature index of smart watch

	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	
Time management																		Geographic information
Time management																		Smart life
Time management																		Sports health
Time management																		Sociality
Geographic information																		Smart life
Geographic information																		Sports health
Geographic information																		Sociality
Smart life																		Sports health
Smart life																		Sociality
Sports health																		Sociality

4 An Analysis of Men and Women's Preference for Smart Watch

4.1 Men's Preference for Smart Watches

According to Table 7, the top five indicators of men's preference for smart watches according to importance from top to bottom are battery time, voice interaction function in interactive mode level, smart life and sports health function in the development of APP level, and waterproof function in the security level. The following is the specific discussion.

As for men's preference for smart watches, battery time is the most prominent feature. In general, due to the diversified development of smart watches and its important role in our daily lives, users rely more on smart watches. Therefore, battery time has also become an important factor to evaluate smart watches. In particular, when users use smart watches in the daytime, they not only watch the clock, but also read the news through the watches connecting to WIFI. Besides, they also make voice calls with friends or family, send and receive text messages and monitor the state of physical movement in real time. These functions are indispensable in use, and they are all based on the power to complete their tasks, which highlights the importance of battery time of the smart watches. If the smart watches lack of electricity, it will bring about a

Table 7. The detailed data of weight distribution about criteria (male)

Criteria	Weight between criteria (%)			Sub criteria	Weight within criteria (%)			Weight among criteria (%)
Interaction	0.1077	0.1822	0.3129	Speech	0.4429	0.596	0.7952	0.1086
	0.1077	0.1822	0.3129	Touch	0.236	0.3107	0.4101	0.0566
	0.1077	0.1822	0.3129	Physic	0.0714	0.0932	0.1277	0.0170
Communication	0.0692	0.1131	0.1975	Auxiliary communication	0.339	0.4995	0.7718	0.0565
	0.0692	0.1131	0.1975	Independent communication	0.3237	0.5005	0.737	0.0566
Security	0.0484	0.0799	0.1324	Waterproof	0.7217	0.8537	1.0073	0.0682
	0.0484	0.0799	0.1324	Theftproof	0.1247	0.1463	0.1741	0.0117
Development of APP	0.1614	0.2867	0.4917	Time management	0.0891	0.1723	0.337	0.0494
	0.1614	0.2867	0.4917	Geographic information	0.045	0.0831	0.1736	0.0238
	0.1614	0.2867	0.4917	Smart life	0.1702	0.3407	0.6686	0.0977
	0.1614	0.2867	0.4917	Sports health	0.1329	0.2662	0.513	0.0763
	0.1614	0.2867	0.4917	Sociality	0.0771	0.1377	0.2521	0.0395
Battery time	0.1564	0.2635	0.4354	Battery time	1	1	1	0.2635

consequence that the products can not be used normally, so that the users can not finish what they originally wanted to do, which makes people feel that it isn't practical, which undoubtedly degrades the user experience. Therefore, battery time has become the most important factor of smart watches. As is pointed out in Apple's promotional literature, the most important feature of Apple Watch is battery time. Other features ranging from health tracking to send and receive text messages are all additional features. According to this, battery time has become the most important factor of smart watches. On the other hand, because of the fast pace of modern life, men are busier in their work and have more compact routines. Therefore, a kind of smart watches which need to recharge repeatedly will increase their trouble in life, which will make them fed up with it. For this reason, smart watches with long battery time catch more attention and recognition of the men.

According to the statistics, users' concern for the voice interaction is second only to the battery time. The specific reasons are mainly divided into three aspects: 1. The natural restriction of the small screens of smart watches requires a higher standard for their human-computer interaction function. This limitation leads to the consequence that it is not suitable for accurate keyboard input and touch gestures, especially in blocking nearly entire screen with a finger. This requires that the users have to click it and input things accurately with their fingertips. This is obviously not suitable for men with large hands. Therefore, voice interaction has become the most reasonable way; 2. Because men attach great importance to efficiency, the natural direct interaction with the machine is particularly important. And language is the most common and direct

way of human communication. Male users can wake up the device at any time, "seamlessly" access to information and give instructions without any sense of jerky and acosmia. This is the most direct and convenient way of interacting of the smart watches.

According to Table 7, in the development of APP application, users attach more attention to battery time and voice than smart life and sports health, but smart life and sports health are ranked close to the top. Smart life is a life service mobile software designed for users, which is powerful to provide users with remote control of household appliances, set timing tasks and other human services. So it is easy to build cloud intelligent life. Specific performance: 1. As for the control household appliances remotely, users can control the switches and other functions at any time. An application can control all the household appliances, in order to meet the needs of living leisurely of more men, which makes life more convenient. 2. The flexibility to set the timing task, accurate execution of the program on time. 3. Share your equipment with family and friends with one click, and enjoy smart life easily. At the same time, the APP of sports health catches more attention of men. Nowadays, male office workers often spend time in the office so that they are unable to have long-time outdoor activities and specially spend time on exercise in the gym. Therefore, they try to record their daily steps and running with APP of the smart watches, which makes it easy to understand their own amount of exercise. Besides, this APP also has some additional features, such as recording daily sleep situations, informing you deep sleep time, light sleep time and awake times every day. And it collects statistics of users weekly and monthly, so the historical statistics can be easily read. Therefore, it catches attention of men.

At the same time, the waterproof function in the security level has also caught attention of male consumers. Waterproof function enhances the practicality of the watches. In the case of rain, the watches are likely to be wet. Therefore, waterproof is an indispensable function of smart watches. In addition, based on the habit of watching clock while swimming, a smart watch used to be worn while swimming will undoubtedly appeal to users. In a word, the waterproof function is a more useful additional feature for male users in the design of smart watches.

4.2 Women's Preference for Smart Watches

According to Table 8, the battery time of smart watch is the biggest concern for women, next is intelligent Life, and then followed by sports health. In the wake of developments in science and technology, smart watch increasingly offers added functionality and strong adaptability, which lead to tremendous improvements in smart watches on power consumption. However, women pay more attention on battery time while they use smart watches. This is because in the process of using smart phones, women spend more time on chatting online, looking through news and shopping online. These has made battery time become the most basic factor, at the same time, a long time of battery provide basic security services. Therefore, better battery time of smart watch has become key concerns when women choose and buy watches.

After battery time, intelligent life is the most focused application for female users, there are three main points: First, some applications of smart life installed on smart

Table 8. The detailed data of weight distribution about criteria (Female)

Criteria	Weight between criteria (%)			Sub criteria	Weight within criteria (%)			Weight among criteria (%)
Interaction	0.1614	0.2817	0.4917	Speech	0.1702	0.3107	0.6686	0.0875
	0.1047	0.1912	0.3029	Touch	0.236	0.3217	0.4131	0.0615
	0.1077	0.1841	0.3126	Physic	0.0714	0.0833	0.1243	0.0153
Communication	0.0673	0.1128	0.1975	Auxiliary communication	0.3382	0.4983	0.7724	0.0562
	0.0694	0.1129	0.1975	Independent communication	0.3237	0.521	0.723	0.0588
Security	0.0491	0.0769	0.1322	Waterproof	0.7217	0.8519	1.0113	0.0655
	0.0473	0.0779	0.1326	Theftproof	0.1247	0.1471	0.1742	0.0115
Development of APP	0.1614	0.2872	0.4921	Time management	0.0893	0.1726	0.3272	0.0496
	0.1614	0.2876	0.4917	Geographic information	0.0452	0.0842	0.1746	0.0242
	0.1077	0.1823	0.3129	Smart life	0.4429	0.587	0.7952	0.1070
	0.1614	0.2823	0.4917	Sports health	0.1702	0.3345	0.6686	0.0944
	0.1616	0.2847	0.4918	Sociality	0.0771	0.1396	0.2523	0.0397
Battery time	0.1564	0.2647	0.4354	Battery time	1	1	1	0.2647

watch that has remote control function. These Apps can operate remotely a portion of household appliances. Smart watch is more convenient relative to the mobile phone. Second, in allusion to home intelligent security systems, users can quickly alert when they wear smart watches. Thus, users can deal with the problem immediately. Nevertheless, mobile phone is not portable in some occasion. Third, women just pass out wrist to show their watches and then can be scan payment when they are shopping in the mall, which makes the way of consumption is more convenient, and the application is very popular among female users.

According to statistics, women's concern for the voice interaction is second only to battery time and smart life. There are three reasons: 1. Smart watches can not only calculate steps as their basic function, they can also detect the users' physical condition and acquire more accurate data than mobile phones because they are close to the skin for a long time; 2. Smart watches are more convenient than mobile phones because users can wear watches but not holding mobile phones for the whole day. For example, in the process of exercise or long-distance running, it is not convenient to carry mobile phones due to the larger amplitude of movement. However, smart watches can be worn on the wrists all the time, so the data of sports health are more comprehensive; 3. The smart watches have a unique health detection function. For example, Cling, a kind of smart watch, is equipped with the light sensor and temperature sensor at bottom, which can directly monitor users' heart rate and body surface temperature and other healthy statistics. It has a more comprehensive intelligent detection function, so the sports health application of smart watches has been favored by users. Furthermore, the sports

healthy application of the smart watches specifically function to record the user's trajectory in order to show the sports results for users in the process of wearing the watches. In addition, this application can also set the target training volume in order to stimulate the users' desire to exercise, thus promoting them to complete the target volume positively. Therefore, the application of sports health encourages women to take exercises and keep fit effectively, which catches attention of women.

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