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Factors influencing the adoption of smart wearable devices

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FACTORS INFLUENCING THE ADOPTION OF SMART WEARABLE DEVICES

by

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ABSTRACT

This study aims to examine the factors and issues in adoption of smart wearable devices. Wearable devices have many functions to offer which make them very useful in our daily lives. However, factors influencing the adoption of these devices are not well understood. This research explores the inhibiting and contributing factors influencing the adoption of wearable devices by employing the laddering approach. Qualitative data were collected through in-depth interviews using the laddering technique in order to understand these factors. Wearable devices that were examined include the Smart Glass (Google Glass) and the Smart Watch (Sony Smart Watch 3). After the participants had the opportunity to try out these two devices, the factors that are most important to them in deciding whether to adopt or not to adopt these devices were laddered. The use of the laddering technique with the Means-End Chain approach not only offers a greater understanding of the factors influencing the adoption of wearable devices, but also reveal the relationships among these factors and any meaningful associations with self (i.e., the user). This research has advanced our understanding on the adoption of wearable devices and provide some insights into the key design criteria to better fit users' needs.

ACKNOWLEDGEMENT

Foremost, I would like to express my heartfelt gratitude to my advisor, Dr. Fiona Fui-Hoon Nah, who has given me the freedom to explore a research topic that is not only of interest but is also passionate to me while providing continuous guidance and encouragement throughout the learning and research process of this master's thesis. Also, I would like to thank all the people who willingly took part in my study for their valuable time and insights. Furthermore, I would like to thank Dr. Keng Siau and Dr. Richard Hall for being part of my thesis committee and taking time to review my work. I would also like to thank all my lab mates and faculty for all the help and suggestions, especially Samuel Smith for being the second coder during the data analysis.

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LIST OF ILLUSTRATIONS

1. INTRODUCTION

This section begins with a discussion of the current state of wearable technology in the market followed by the motivation for conducting this research. The main research question and a brief outline of the proposed research approach are also presented. The section closes with an outline of this thesis along with its main research contributions.

1.1 CHALLENGES FOR WEARABLE TECHNOLOGY ACCEPTANCE

Wearable technology is often talked about and is hyped these days. Wearable devices are everywhere and are as commonly used as mobile phones. Wearable technology was the cover story for the September 2014 issue of Time magazine. Since the first ever wearable device—the Bluetooth headset, which debuted in 2000—wearable devices seem to have finally arrived in the mainstream market. Wearable technology has experienced a lot of challenges before getting the big break into the mainstream market and being accepted by people. Some very common challenges include battery life, display, privacy, etc. As the technology continues to evolve, some challenges have been overcome while new ones have arisen. All in all, wearable technology has always seen a hesitation when being adopted by people, which brings us to our research question: What are the factors that influence the adoption of smart wearable devices? While some factors contribute to the adoption of wearable technology, others inhibit the adoption, i.e., some features or factors make users want to adopt smart wearable technology, while others make them not want to adopt smart wearable technology. As such, the primary research question is a two-fold question: What are the contributing factors for adoption of smart wearable devices, and what are the inhibiting factors for adoption of smart wearable devices?

1.2 RESEARCH APPROACH

The important aspect of this research is to identify the factors that influence a user's decision to adopt or not to adopt smart wearable devices. This was done using the qualitative approach in order to gather very rich data from the subjects using in-depth interviews. While the primary goal of this research is to identity the factors that influence a user's decision to adopt or not to adopt wearable devices, it is also useful to understand the underlying values behind each of these factors. In order to identify these values, the laddering methodology was adopted. The factors elicited from the users were laddered by asking why a factor is important to them. Each factor is laddered to a consequence and its respective values. Thus, we are not only able to gather factors that influence the user's decision to adopt or not to adopt smart wearable devices, but also substantiate the value offered by each factor to the users.

1.3 THESIS ORGANIZATION

The rest of the thesis is organized into six sections as follows.

Section 2 reviews technology adoption models and studies on wearable technology adoption in the literature.

Section 3 describes the research methodology along with the reasons for the choice of the research approach.

Section 4 explains the data collection procedures and the interview process.

Section 5 describes how the data was parsed and analyzed, and presents the results in the form of hierarchical value maps.

Section 6 discusses limitations of this research along with future scope and ideas intended as a guide to future research.

Finally Section 7 concludes the thesis with a summary of the research and its results, as well as the implications.

2. THEORETICAL FOUNDATION AND LITERATURE SURVEY

2.1 MODELS OF TECHNOLOGY ADOPTION

To lay the foundation for our research, we drew upon three established models found within the literature that are related to the acceptance of technology: Technology Acceptance Model (TAM), Innovation Diffusion Theory (IDT), and Unified Theory of Acceptance and Use of Technology (UTAUT). The Technology Acceptance Model (TAM) was developed in 1989 and has seen an ample number of applications within technology acceptance research, and thus, has received significant empirical support. TAM is centred around two core constructs—perceived ease of use and perceived usefulness. Perceived ease of use is defined as "the degree to which the user expects the target system to be free of effort" [1, p.26]. Perceived usefulness is defined as the user's "subjective probability that using a specific application system will increase his or her job performance within an organizational context" [1, p.26]. Although TAM has seen relatively few applications in the context of wearable device acceptance due to the novelty of this research area, the very nature of TAM allows it to be "capable of explaining user behaviour across a broad range of end-user computing technologies and user populations" [1, p.34]. Furthermore, TAM has been "applied to a diverse set of technologies, contexts and users" [2, p.428], including the context of fairly recent technological advancements such as smartphones [3, 4]. For our research on the acceptance of wearable devices, the two core constructs of TAM – perceived ease of use and perceived usefulness – are particularly relevant. Furthermore, perceived ease of use falls in line with one of Dvorak's [10] outlined elements for the acceptance of wearable technology. Hence, we expect the constructs in TAM to be highly relevant and appropriate for our research.

Roger's Diffusion of Innovation (DOI) theory was developed in 1962 to understand and explain how a product or idea is perceived and adopted by different social groups [5], which coincides with the nature of our research. DOI has been applied to a variety of technology adoption research, ranging from factors that drive mobile commerce [6] to social media usage [7]. DOI theory encapsulates a number of constructs: (1) relative advantage, (2) compatibility, (3) complexity, (4) trialability, and (5) observability. The first construct, relative advantage, refers to the gains that result from the adoption of an innovation. Since one of our research goals is to determine if there are any new characteristics of smart wearable technologies that significantly influence their rate of adoption, the construct of relative advantage is expected to be relevant, not to mention that it is similar in concept to perceived usefulness in TAM. In addition, it is worthwhile to take complexity into account, as previous technology adoption research has found complexity to be a contributing factor. Furthermore, complexity is related to perceived ease of use, a core construct of TAM, which we have previously discussed.

The Unified Theory of Acceptance and Use of Technology (UTAUT) was developed in 2003 for the purpose of measuring the variety of perceptions held within the information technology innovation context [8]. The core constructs used in UTAUT are (1) performance expectancy, (2) effort expectancy, (3) social influence, and (4) facilitating conditions. While all of these constructs are applicable for our research, the first three are particularly relevant. For instance, performance expectancy and effort expectancy tie in closely with the core constructs in TAM i.e, perceived usefulness and perceived ease of use respectively. In our research, these two constructs will be referred to as the benefits of using a smart wearable device and the effort required to use a smart wearable device. Social influence is also expected to play an important explanatory role in our research since previous literature on wearable technology [9] has indicated support for this construct.

2.2 STUDIES ON ADOPTION OF WEARABLE TECHNOLOGY

Along with the technology adoption models discussed above, there are some recent studies that focus on wearable devices and their adoption. Among the studies on technology acceptance and technology adoption, very few studies focus on wearable technology adoption. This thesis is one of the first scholarly attempts to understand the adoption of smart wearable technology.

The term wearable or wearable technology has been defined in several ways in the literature. In the book, "Moving Wearables into the Mainstream: Taming the Borg," authored by Joseph Dvorak [10] who has over 10 years of experience in wearable technology and design, he specified some of the most important characteristics and design elements for wearables to be widely adopted. He identified five broad elements that affect the acceptance of wearable technology in the mainstream: wearability, ease of use, compelling design, functionality, and price.

Rhodes [11] identified three important criteria for wearable devices: portable while being operational, needing minimum manual input, sensitive to the user's attention even when not actively used. Mann [12] identified three desirable characteristics for wearable systems: situated physically such that the user and others consider it part of the user, controlled by the user, and having negligible operational delays. Based on Feiner's [9] study, he stressed the importance of a wearable being mobile and that "mobility breeds collaboration". The other criteria he deems important are appearance/attractiveness, comfort, optically transparent, and inexpensive. As such, several researchers have identified various criteria for wearable devices. In this research, we will use a qualitative approach that is grounded in data to identify a comprehensive set of factors influencing wearable device adoption and compare the factors that we have identified with those in the literature.

A wearable technology should yield user experience that allows the user to be only minimally aware of the system in order to stay focused on the task at hand. The basic capabilities specified by Dvorak [10] in order to achieve positive user experience with wearable technology are flexibility, adaptability in the user interface, environmental and situational awareness, compelling applications, intelligence, and low operational inertia (OI) design. OI refers to the resistance a device, service, or system imposes against its use due to the way it is designed.

Studies which focus on the social aspects of wearables have found that gender and culture play a crucial role in the acceptance of wearable devices as well. In the study, Perception of Wearable Computers for Everyday Life by General Public: Impact of Culture and Gender on Technology conducted by Duval and Hashizume [13], they found that although there are some common interests across gender and cultures, there are also significant divergence such as system autonomy. Feiner [9] considers social acceptance of a wearable device as a major influence of the tracking accuracy. He says this because devices that track data are not yet fully accepted by everyone. So the accuracy of this tracking data is debatable as it’s gathered from very few devices. He further adds that what we share or what information we release to be tracked may also depend upon social protocols.

Another key challenge for wearable technology is battery life [14]. Wearables are expected to be small and thin, but there is hardly any space left for the inclusion of a larger battery. Longevity of the battery ensures availability of the device when needed for longer use.

Billinghurst and Starner [15] indicated that a wearable device should satisfy three goals: they must be mobile, they must augment reality, and they must provide context sensitivity in order to have some practical value in the real world. Wearable devices need to become more intimately connected to our daily lives while combining collaboration, computation, and context sensitivity in order to enhance personal productivity. All the computational needs/functions should be carried out by these devices in order for the human brain to focus more on creativity. This can be achieved by augmenting artificial intelligence over human intelligence and by making information gathering and filtering more natural like a daily activity of life.

In another study entitled "An Acceptance Model for Smart Watches: Implications for the Adoption of Future Wearable Technology" by Kim and Shin [16], they developed an extended Technology Acceptance Model by integrating the original model with key psychological determinants of smart watch adoption. Their findings show that the psychological determinants, affective quality and relative advantage of smart watches, were found to be associated with perceived usefulness, whereas mobility and availability contributed to greater perceived ease of use of the technology.

Many of the above studies make use of technology adoption theories and models which we have discussed in the earlier part of this section.

3. RESEARCH METHODOLOGY

This study is explorative and inductive in nature. This qualitative research made use of rich data that were collected through in-depth interviews with students and staff of a Midwestern university. To understand contributing and inhibiting factors in the adoption of smart wearable devices, this research utilized a grounded theory approach in order to analyze the rich data gathered from the interviews and organize them into a map that shows the important factors influencing the adoption of a smart wearable device. In order to discover and understand the fundamental values of factors influencing the adoption of wearable devices, we utilized the laddering methodology [17]. The methodology can also identify attributes of products that are of value to consumers or users. These attributes can be laddered to produce or identify consequences offered to the user. The consequences are the functional benefits of an attribute as viewed by the user. These consequences are in turn laddered to identify the personal values of the user, which determine their attitude toward the product. The laddering methodology is similar to means-end theory [18] in that the attributes can be seen as "means" while the values can be seen as "ends". However, it is also different because means-end theory focuses more on the importance of each consequence, while laddering methodology focuses on the importance of the attribute-consequence-value linkages. The laddering methodology explains attributes as product characteristics that are easily identifiable by individuals. These attributes have one or more consequences which are the perceived functional benefits or issues associated with a product. Every consequence reinforces personal values or emotional benefits that are important to the individual. Understanding the linkages is necessary in order to substantiate the factors that influence user's decision to adopt wearable devices. The laddering methodology can best answer the research question because the methodology is based on the "argument that consumer choice reflects a relationship between product attributes, the consequences of selecting the product, and desired end-states, or values." [19]

4. DATA COLLECTION

Data was collected from 25 individuals from a Midwestern university. Out of the 25 individuals, 15 were students—both graduate and undergraduate—and 10 were university staff. The first group that comprises students is called the student/non-working group and the second group that comprises university staff is called the working group. Two sets of user groups were interviewed in order to check if the consequences, values, and linkages differ between the students who have little to no income versus the staff who work full time and earn a steady income. In analyzing the data, both sets (working group and student group) were analyzed independently and their differences are highlighted and discussed.

4.1 DATA COLLECTION PROCEDURES

In order to capture two different types of smart wearable devices, the Google Glass and Sony SmartWatch 3 were utilized during the in-depth interviews. The Google Glass was used to represent heads-up and head-mounted displays, while the Sony SmartWatch 3 with fitness tracking abilities was used to represent smart watches. In the data collection process, each in-depth interview consisted of five parts. It began with the demonstration of one device, either Google Glass or the Sony SmartWatch 3. We alternated the order of device demonstrations between participants; if one participant had Google Glass demonstrated first, the next participant would have the Sony SmartWatch 3 demonstrated first. The demonstration included a video demo, which was a YouTube video created by the manufacturer of the device that demonstrated the usage and basic functionality of the device, followed by a live demonstration by the researcher specifying all the hardware and software specifications of the device. After the demos, the subject could use and gain experience with the device by trying out the device for five minutes. The first part ended with two questions which asked the participant to specify the top three factors that would make them want to adopt the device and also the top three factors that would make them not want to adopt the device. The same procedure was followed for the second device along with the same questions.

The next part of the data collection process was to elicit distinctions between the devices. According to the laddering methodology, [17] at least two eliciting distinction methods must be used when utilizing the laddering technique. Eliciting distinctions help in probing more meaningful differences between products in order to ladder them later. These differences that are mentioned by the user provide a basis to ask more "Why is it important to you?" questions thus building more ladders. The two eliciting distinction methods used in this paper are triadic sorting and preference consumption differences. [17]

During the triadic sorting phase of eliciting distinctions, the subject was presented with three visual cards. Each visual card contained a picture of its respective device, i.e., Sony SmartWatch 3, Google Glass, and a smartphone. Hence, each visual card represented a specific device. The smartphone was included during this phase to provide the subject with a reference for a common smart device; every subject indicated familiarity with a smartphone. The subject was then asked to compare the devices and state their differences (see below for the sample questions). These differences may affect the subject's level of interest to adopt one or more of the devices.

Researcher

"I would like to ask you to tell me some important ways in which the smartphone differs from Google Glass and Sony SmartWatch."

"I would like to ask you to tell me some important ways in which Google Glass differs from the smartphone and Sony SmartWatch."

"I would like to ask you to tell me some important ways in which Sony SmartWatch differs from Google Glass and the smartphone."

In the preference-consumption differences phase of eliciting distinctions, the subject was asked to place the visual cards with the device pictures in the order which they would prefer to adopt, with 1 being the most likely to adopt and 3 being the least likely to adopt. Next, the subject was asked to place the cards in the order of their usage, with 1 being the most used device and 3 being the least used device. Throughout the process, the subject was asked to think out loud and express their thoughts on why they chose to place the device pictures in the order of their choosing. The subject was also asked open-ended questions to encourage elaborations (see sample questions below). Doing so provided the researcher an opportunity to gain further insight on factors that influence the subject's decision to adopt the wearable devices.

Researcher:

Why do you prefer 1 over 2?

Why is 3 least preferred?

Which one do you like the most? Which one do you use the most? If they're different, why?

All of the factors were then gathered and rated by the subject based on importance using a 5-point scale, i.e. 1 = not important at all, 2 = slightly important, 3 = moderately important, 4 = very important, and 5 = extremely important.

After each of the factors were rated, the researcher began the laddering process. Starting with the highest-rated factors, the subject was asked why a particular factor is important to them. If necessary, the subject was asked multiple open-ended questions until they stated a value which was linked to the initial attribute. With the identification of this value, the laddering process for the attribute was completed.

5. ANALYSIS AND RESULTS

Qualitative data from 25 participants was parsed and the laddering technique was applied to form several attribute-consequence-value linkages. Each attribute-consequence-value linkage is called a ladder. For example, an illustration of the ladders linking an attribute, Tech Novelty (lowest level), a consequence, Professionalism (middle level), and two values, Respect and Image (highest level) shown in Figure 5.1.

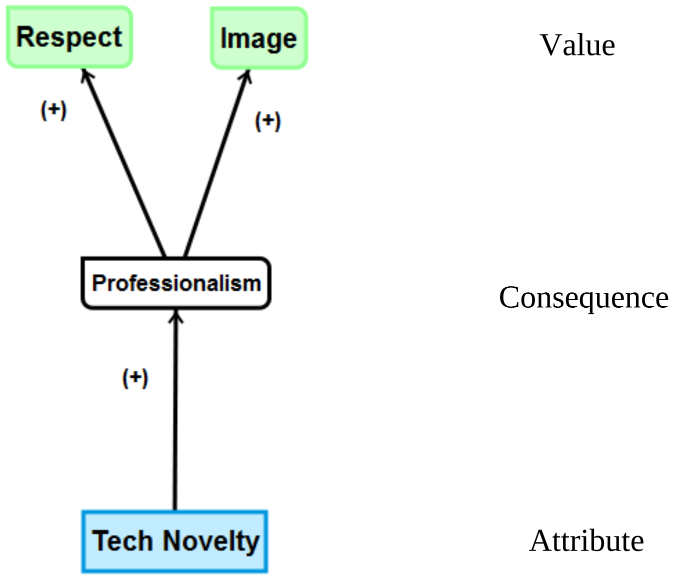

Figure 5.1: Ladder

In other words, Tech Novelty is the attribute mapping to the consequence, Professionalism, which maps to the values, Respect and Image. The blue box represents the first level or the *attribute* level, and the green box represents the top most *value* level. The rest that are presented in the intermediate level(s) are the *consequence(s)*. Each linkage is a relation that can be positive or negative. A positive relation is denoted by a (+) sign and a negative relation is denoted by a (-) sign. In this example, Tech novelty positively influences Professionalism i.e., the newness of the technology increases professionalism, and Professionalism increases Respect and Image. These ladders were formed from the interview data where the interviewer asked ‘why is it important’ question for every element that the subject mentioned as an important factor.

All such ladders were parsed and the factors that were similar in meaning were combined into one common abstract concept to capture the overall meanings or concept. A map was generated for each category or group of data, i.e., one map for each set of contributing and inhibiting factors for each smart wearable device (Google Glass and Sony Smart Watch) and with different maps for the two user groups, student and working groups. The following are the 8 maps generated to summarize the findings from this research:

1. Google Glass Contributing Factors – student group
2. Google Glass Contributing Factors – working group
3. Google Glass Inhibiting Factors – student group
4. Google Glass Inhibiting Factors – working group
5. Smart Watch Contributing Factors – student group
6. Smart Watch Contributing Factors – working group
7. Smart Watch Inhibiting Factors – student group
8. Smart Watch Inhibiting Factors – working group

A map is simply an aggregation of all relevant ladders in three layers – attributes, consequences and values. For example, the first map titled “Google Glass Contributing Factors - student group” is a representation of all the smaller ladders mentioned by the student group on contributing factors to adoption of Google Glass smart wearable technology.

Reading a map is fairly straight-forward. As mentioned previously, it has 3 layers, the first or bottom layer has the attributes or factors, the second layer has consequences, and the third or top most layer has values. In this research, all the attributes are colored blue and the values colored green to facilitate identification of attributes, consequences, and values. The relations as mentioned before are denoted as (+) if it is a positive relation and (-) if it is a negative relation.

The 25 subjects who participated in this study fell in two different categories – student group and working group. The student group consisted of 15 subjects who were 9 male and 6 female undergraduate and graduate students in the age group of 19-25 years. The working group consisted of 10 subjects who were 4 male and 6 female university staff in the age group 26-50 years old. The data collected from the subjects was analyzed separately for the two groups (student and working) in order to understand the differences in the values between the two groups.

Also, during the data analysis stage, a second coder was hired to analyze the data independent of the researcher's analysis in order to gather a more complete perspective in laddering and forming the maps. After both the coders analyzed the raw data, any differences between them (e.g., categorizing and naming of elements) were resolved through consensus among the two coders.

5.1 INTER-RATER/CODER RELIABILITY

As the data is qualitative in nature, having a second coder to analyze the data helped to make the results more reliable as some of the thoughts mentioned by the subjects in the interviews could be interpreted differently. Hence there was a second coder for data analysis.

As mentioned earlier, having more than one coder helped to improve the reliability of the results. For example, when a subject from the student group was asked about the contributing factors to the smart wearable device - Smart Watch - the screen size and the hardware design of the device were noted as important factors in deciding whether or not to adopt the device. These factors fall in the attribute level of laddering and the subsequent interview conversation centered around why these factors were important. While analyzing this data, the first coder inferred that the factor in the case of screen size should be called the Display while the factor, Design should be left as is. But according to the second coder's interpretation, both the factors, screen size and design, can be clubbed into one factor called Form Factor (refer to Figure 5.5). The term, form factor, gathers both factors about design considerations very well which the subject was trying to explain. So after some discussion and taking into consideration what other subjects who mentioned the same factors meant, we decided upon the term, Form Factor.

Another such example in the coding process relates to the factor GPS. The first coder combined both GPS feature and the accuracy of the feature in the same factor labelled GPS and hence it was not possible to differentiate between subjects' frustration or satisfaction with the GPS of the Google Glass, due to the inaccuracy of the maps and other navigation functionality provided by the GPS. So both the coders decided that GPS accuracy in itself can be considered a factor which the subjects linked to satisfaction that in turn, increased the usefulness of the device, which in turn increased the value for money – a personal value for the subject. (see to Figure 5.1)

Having a second coder and coming to a consensus for some terms was very helpful because the data was in the form of raw concepts generated from the interviews. When more than one subject indicated a factor, they might make use of different words or phrasings while referring to the same thing. Consolidating and standardizing the raw concepts into a generic form was necessary as they facilitated the forming and generation of the maps using these abstract and generic concepts and resulted in more meaningful and reliable results. The maps that were generated from this research were shown next.

Figure 5.2 is a map representing all the ladders (attribute-consequence-value linkages) mentioned by the respondents, in the student category, when asked about the contributing factors for Google Glass. The contributing factors for Google Glass as mentioned by the student group are Brand, Functionality, Hands-free, Compatibility, Interface, GPS, GPS Accuracy, Voice Recognition Accuracy, Technology Novelty, Messaging and Social Media Apps, Look and Feel. The concept, brand, refers to the meaning associated with the brand of the smart wearable device, in this case Google, that was found to be an important contributing factor to adopt a smart wearable device. Brand was also a factor mentioned only by the student group but not the working group.

Participant 5 mentioned the following:

"If it's a brand I love, like Google, I automatically assume they come up with something exciting… something I'm gonna like"

Another participant, Participant 6 stated the following:

"I'm more likely gonna buy it, if it's a known brand"

And when asked why, Participant 6 said "Then I know it has good buyer support, so I can use it longer without having to spend more money on a new one"

All the attributes or factors in blue are linked to one or more consequences which are linked to the values in the top most layer, colored green. The values that were found in the "Google Glass Contributing Factors – student group" were Value for money, Interest/Passion, Family Value, Belonging and Image. All the relations in this map are positive relations.

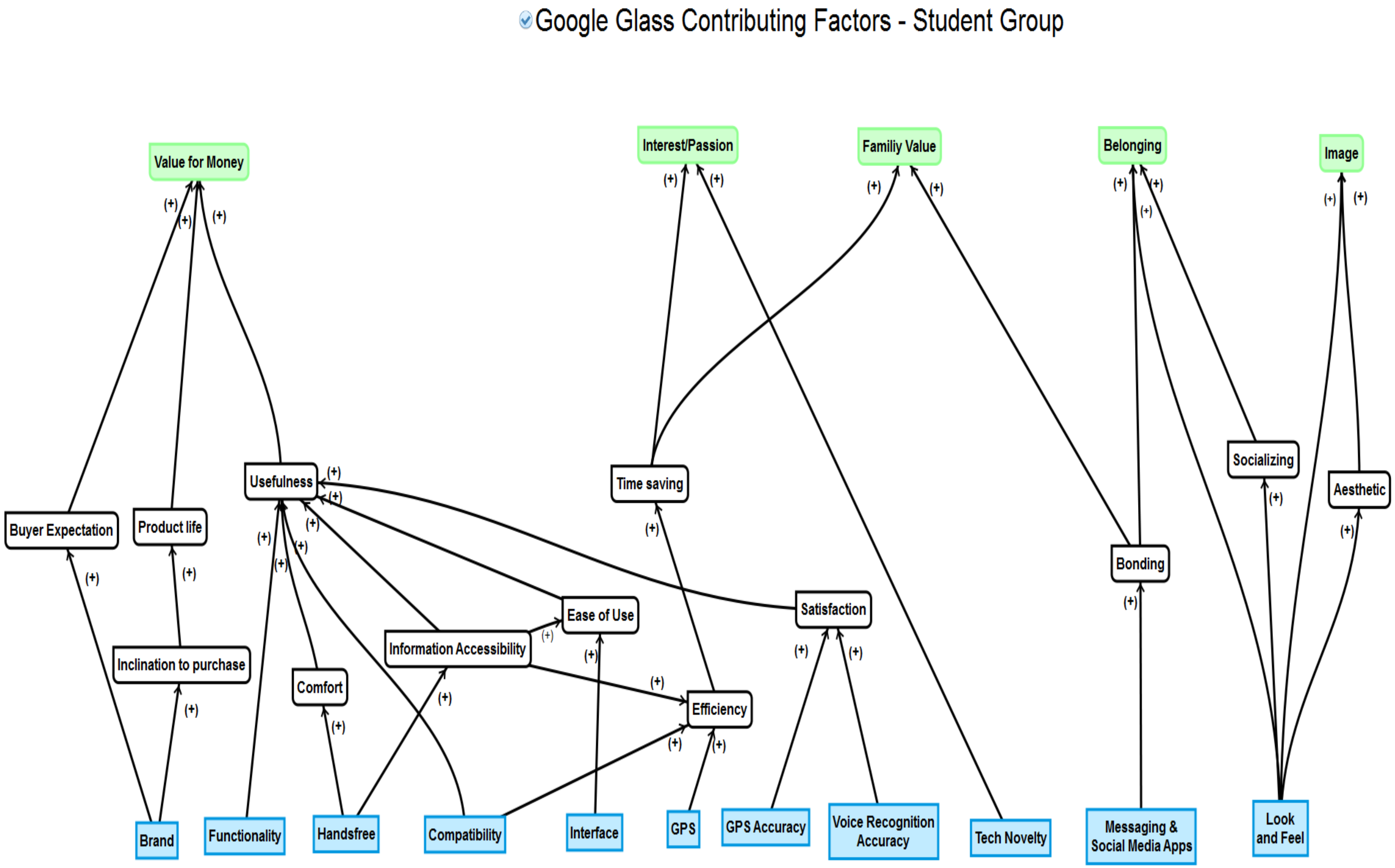

Figure 5.2: Google Glass Contributing Factors - Student Group

Figure 5.3 is a map representing all the ladders (attribute-consequence-value linkages) mentioned by the respondents, in the working category, when asked about the contributing factors for Google Glass. The contributing factors for Google Glass mentioned by the working group are GPS, Handsfree, Internet Access, Compatibility, Messaging and Social Media Application, Technological Novelty, and Look and Feel.

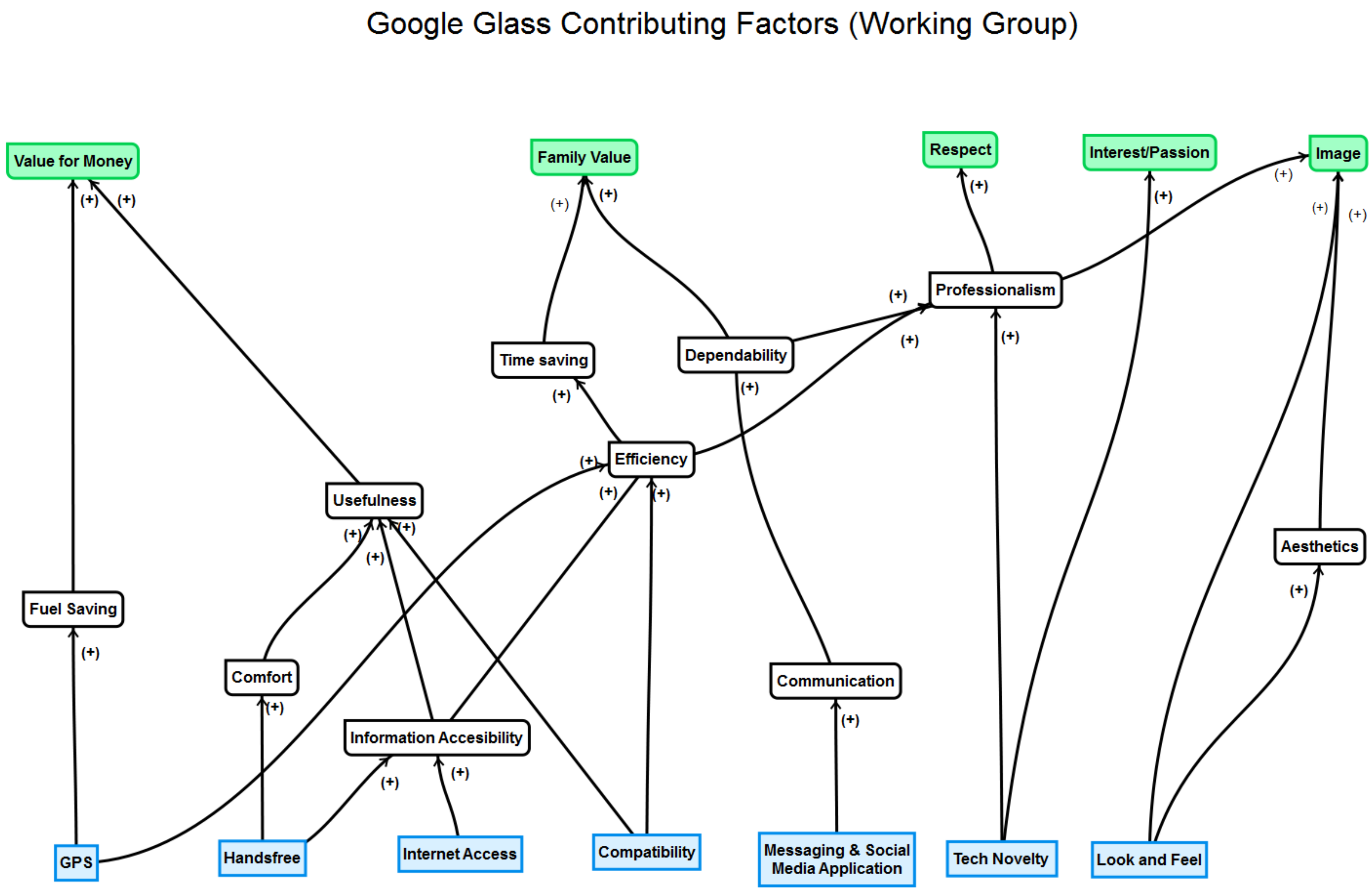

Figure 5.3: Google Glass Contributing Factors - Working Group

Figure 5.4 is a map representing all the ladders (attribute-consequence-value linkages) mentioned by the respondents, in the student category, when asked about the inhibiting factors for Google Glass. The inhibiting factors for Google Glass mentioned by the student group are Price, Lack of knowledge, Technological Novelty, Interface, Form factor, Battery life, Battery Heat, and Look and Feel.

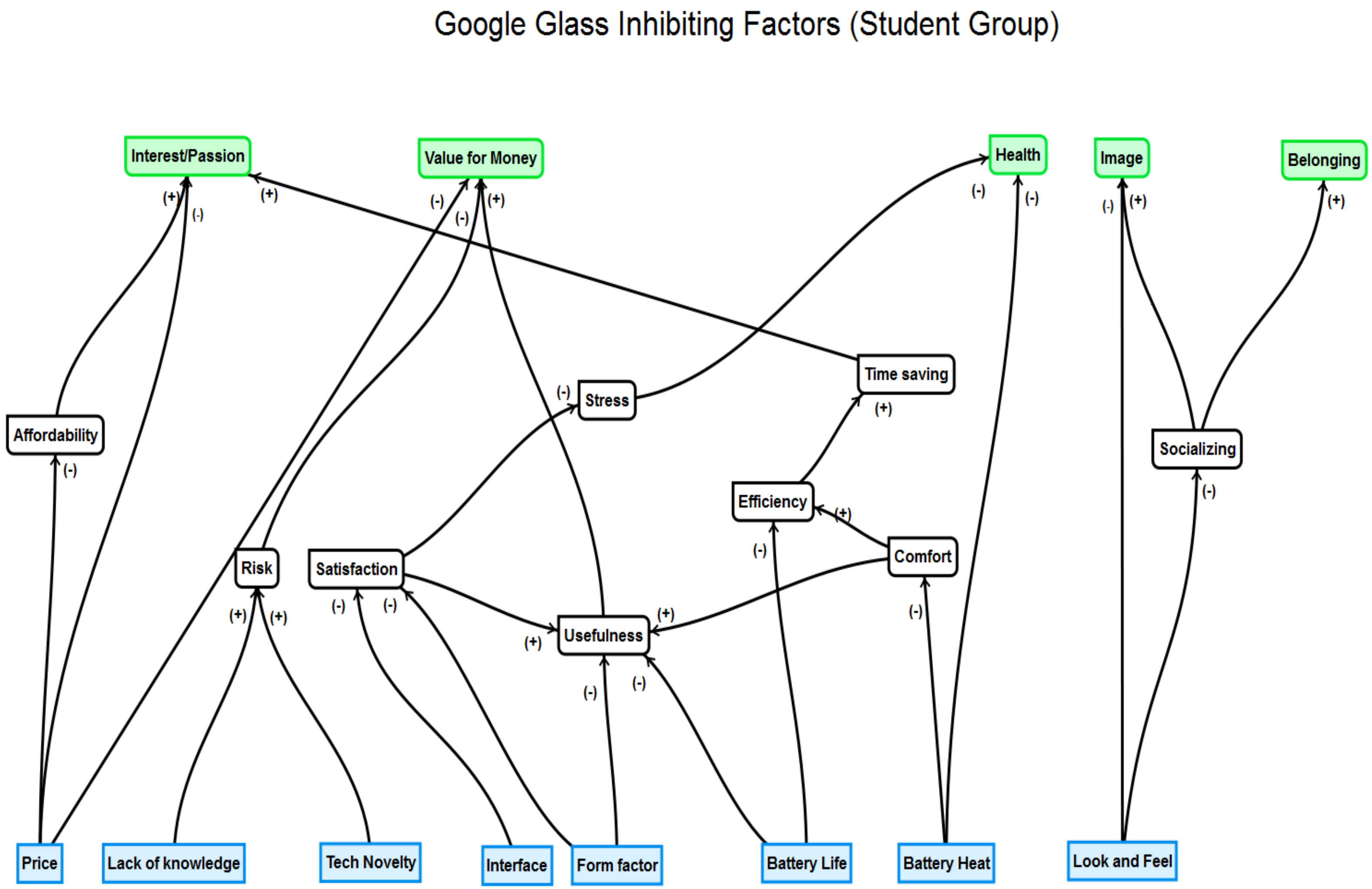

Figure 5.4: Google Glass Inhibiting Factors - Student Group

Figure 5.5 is a map representing all the ladders (attribute-consequence-value linkages) mentioned by the respondents, in the working category, when asked about the inhibiting factors for Google Glass. The inhibiting factors for Google Glass mentioned by the working group are Weight, Battery Heat, Interface, Battery Life, Form factor, Technological Novelty, Information Privacy, and Look and Feel.

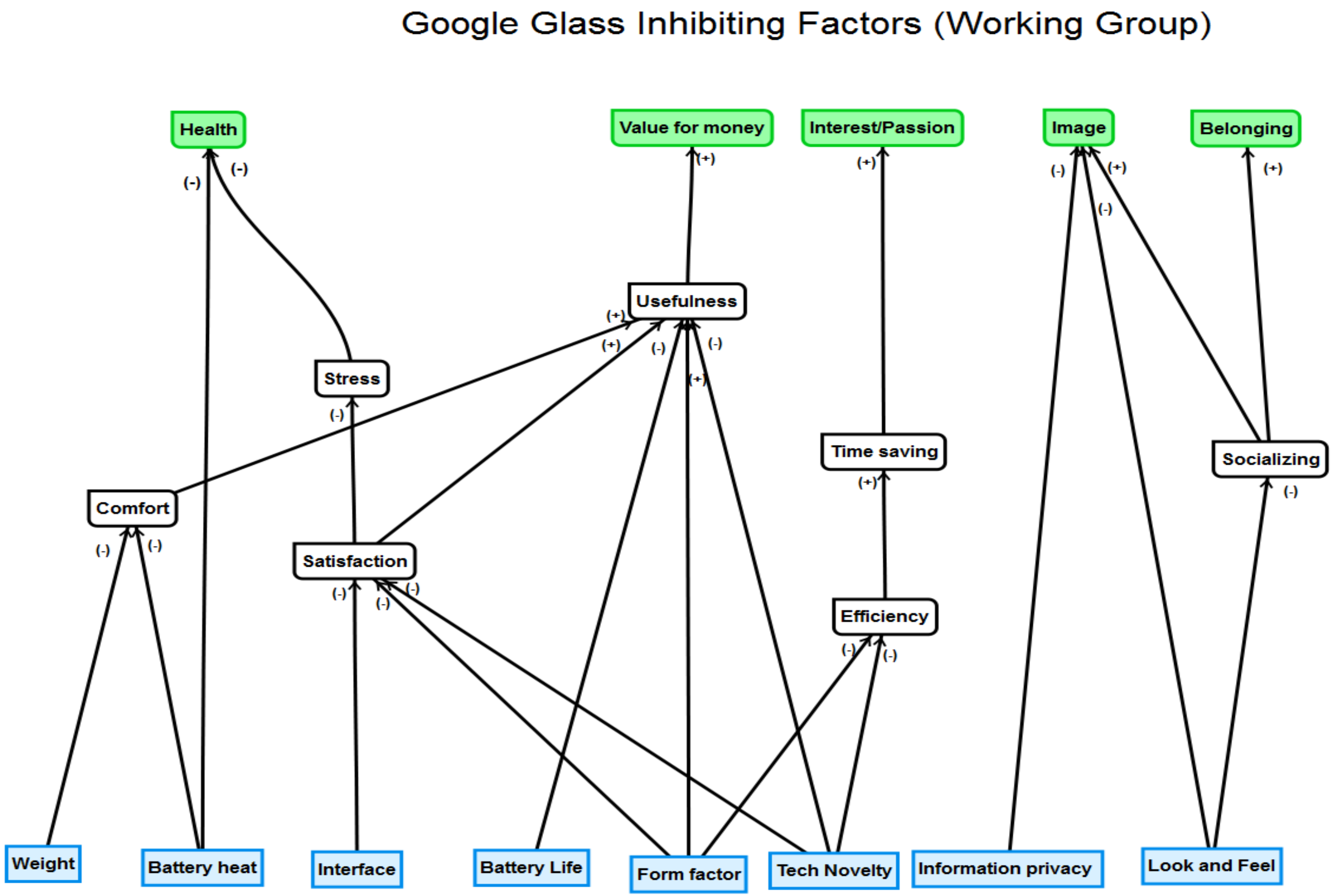

Figure 5.5: Google Glass Inhibiting Factors - Working Group

Figure 5.6 is a map representing all the ladders (attribute-consequence-value linkages) mentioned by the respondents, in the student category, when asked about the contributing factors for Sony Smart Watch. The contributing factors for Sony Smart Watch mentioned by the student group are GPS, Messaging and Social Media Apps, Handsfree, Interface, Technological Novelty, Fitness Apps, Battery Life, Form Factor, Look and Feel, and Waterproof.

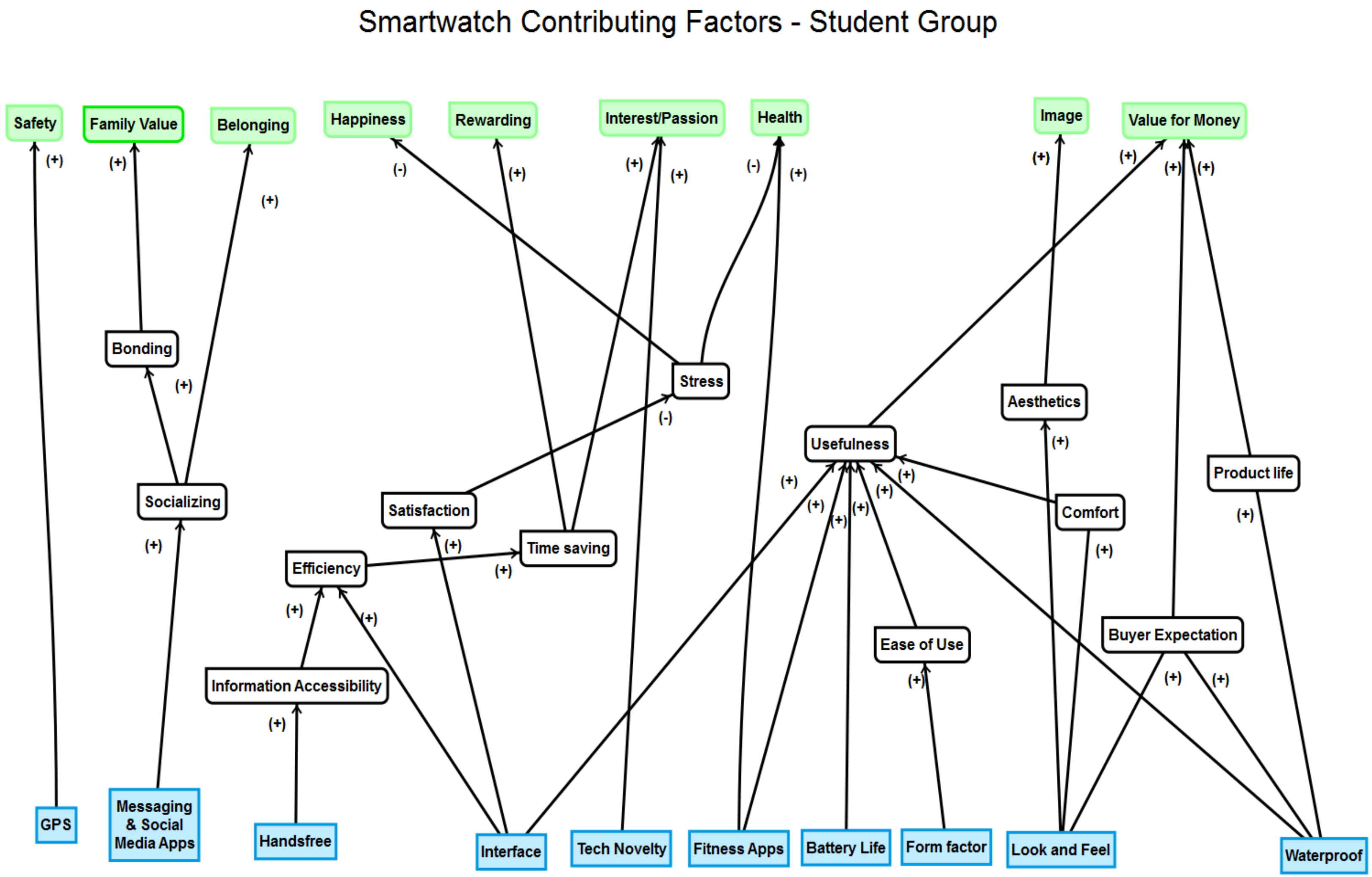

Figure 5.6: Smart Watch Contributing Factors - Student Group

Figure 5.7 is a map representing all the ladders (attribute-consequence-value linkages) mentioned by the respondents, in the working category, when asked about the contributing factors for Sony Smart Watch. The contributing factors for Sony Smart Watch mentioned by the working group are Technological Novelty, Waterproof, Notifications, GPS, Compatibility, Interface, Form Factor, and Fitness Apps.

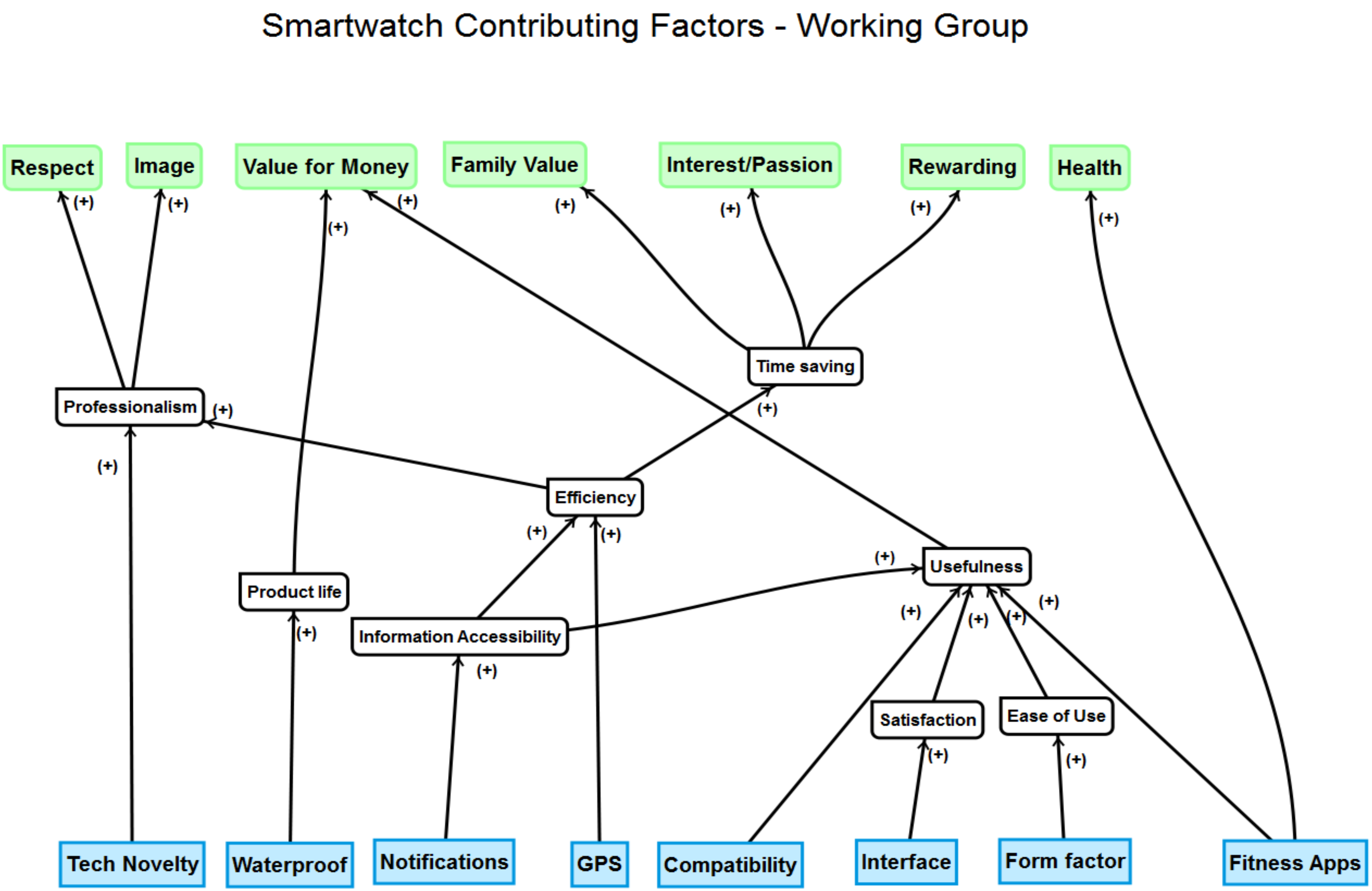

Figure 5.7: Smart Watch Contributing Factors - Working Group

Figure 5.8 is a map representing all the ladders (attribute-consequence-value linkages) mentioned by the respondents, in the student category, when asked about the inhibiting factors for Sony Smart Watch. The inhibiting factors for Sony Smart Watch mentioned by the student group are Notifications, Weight, Brand, Functionality, Battery Life, Look and Feel, Price, and Information Privacy.

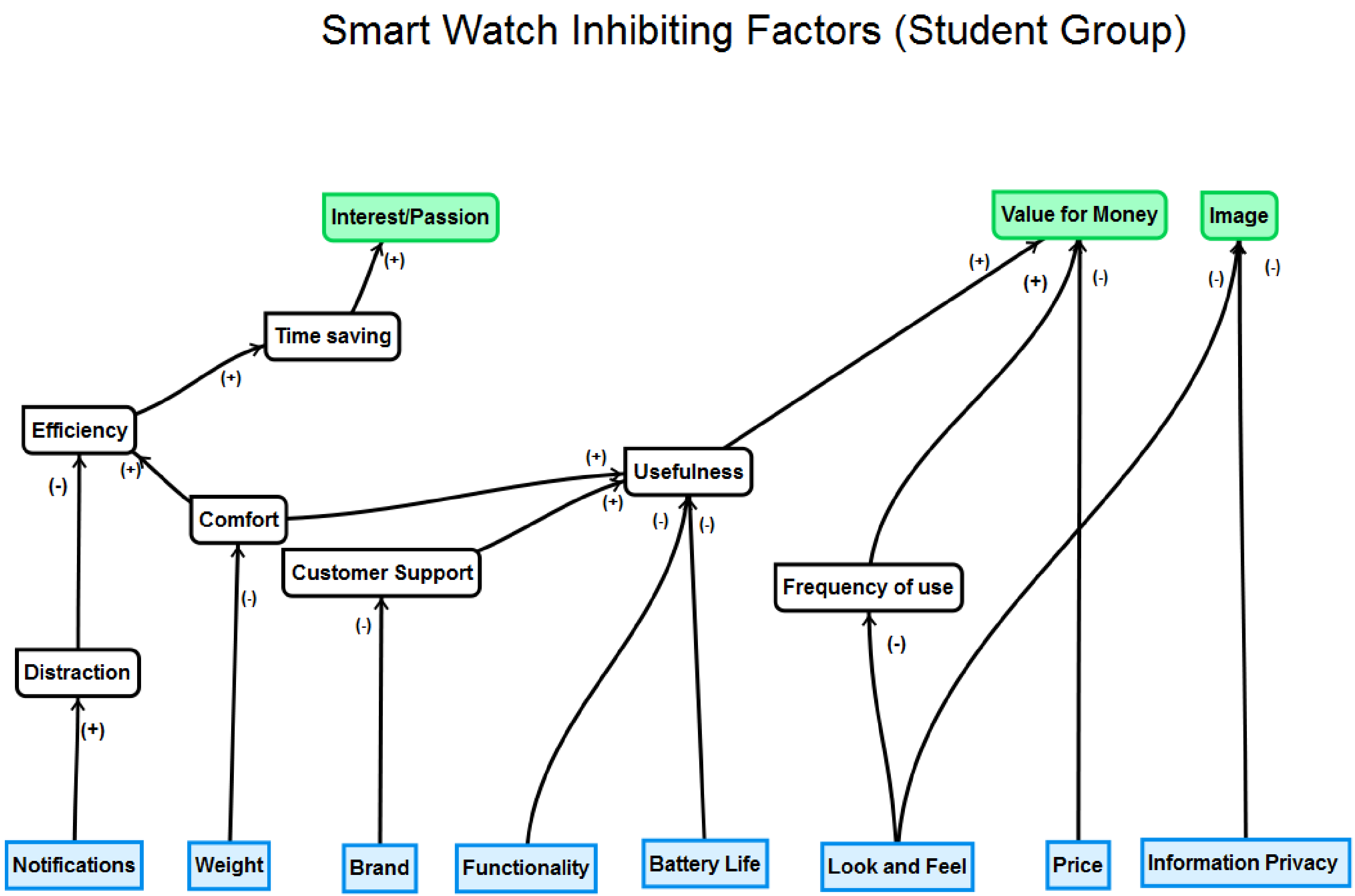

Figure 5.8: Smart Watch Inhibiting Factors - Student Group

Figure 5.9 is a map representing all the ladders (attribute-consequence-value linkages) mentioned by the respondents, in the working category, when asked about the inhibiting factors for Sony Smart Watch. The inhibiting factors for Sony Smart Watch mentioned by the working group are Battery Heat, Weight, Form Factor, Interface, Functionality, Battery Life, and Look and Feel.

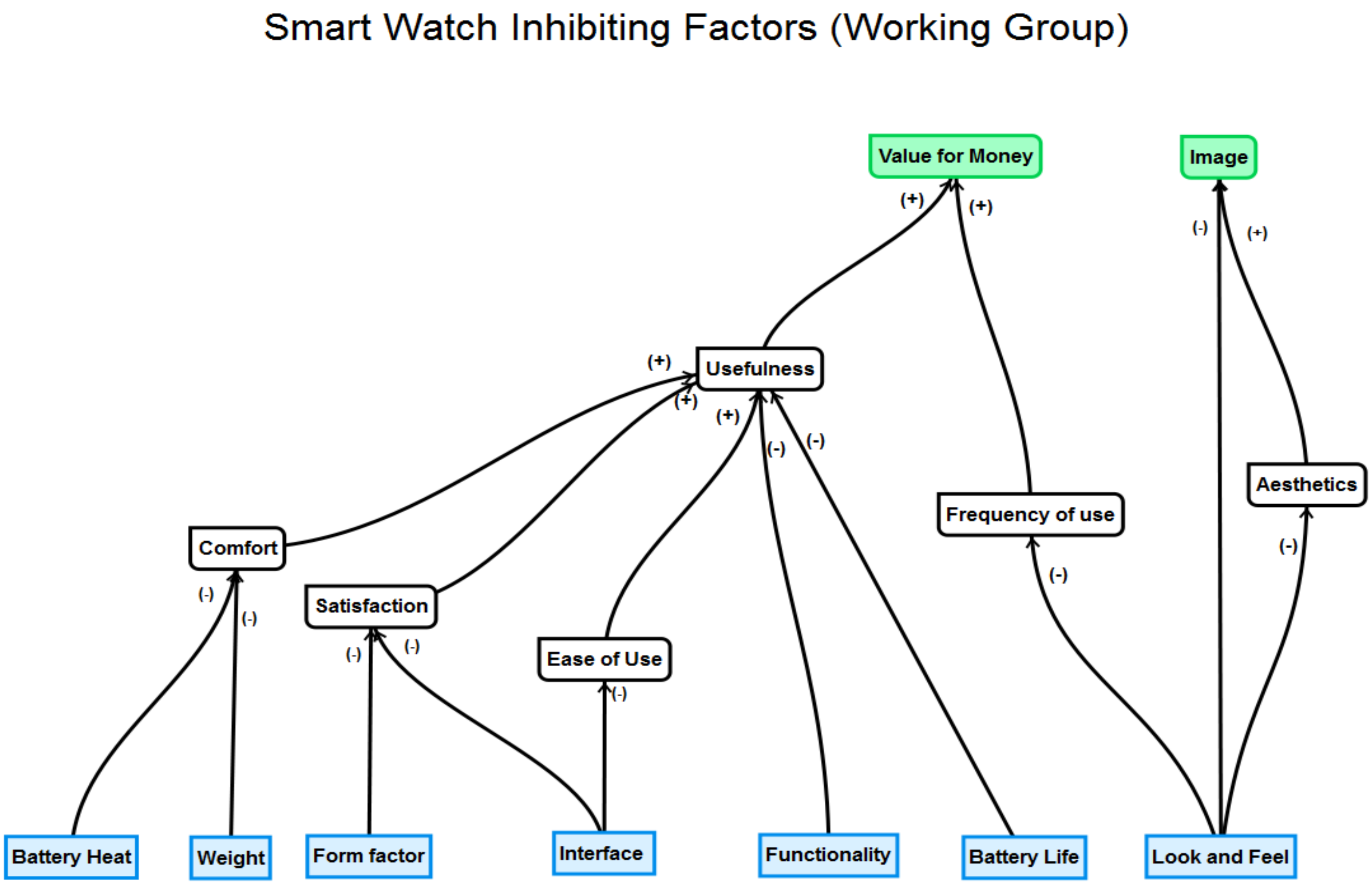

Figure 5.9: Smart Watch Inhibiting Factors - Working Group

5.2 MAJOR FINDINGS

5.2.1. Smart Glasses. Some of the major findings from the results were about the top factors that influenced the decisions whether to adopt or not to adopt a smart wearable devices. For heads up displays or smart glasses the look and feel was one such factor which was mentioned by the majority in influencing users' decisions to adopt. As the smart glasses sit right on the face it is important for the device to look good and feel good. Look and feel has other deeper reasons like Image as a personal value. Along with the look and feel, a lot of subjects also mentioned weight of the device to be an important factor for smart glasses as one subject responded "wouldn't want something that weighs half a pound on my head all day long". So it was found that it is very important that the device is very lightweight and sleek looking.

Battery related issues like battery life and battery heating were also some other important factors that were repeatedly mentioned. Battery heating was a matter of concern because the smart glasses go right on the face and having something hot right beside your temple or anywhere on the head was considered very uncomfortable while being a major health concern. Battery life was pointed out several times by both the student and working groups as there was apparently "no point carrying a device if you had to charge it every 3-4 hours." It was also found that not being able to use a device when necessary due to a dead battery made it not worth the money spent. Other factors that played a significant role in the decision to adopt smart wearable devices were Internet access, GPS and messaging and social media apps. These three factors were particularly important, i.e., to be able to have information access and be able to bond, and messaging and social media apps. The first two factors information access, bonding, and messaging and social media apps related to the personal value, family value, and interest and passion. Internet access, GPS and GPS accuracy improved efficiency which saved more time to pursue interest and passion. The handsfree functionality was also important for the same reasons of being more efficient and this is because a wearable technology was expected to be handsfree and this made the users perceive more worth for the money spent.

5.2.2. Smart Watches. Some of these factors carried over to the device smartwatch as well, but one other important factor that was found to be particularly important in the adoption of smartwatches was fitness apps. This can be contributed to the current trend in the market for fitness bands. Having fitness apps in smartwatches is one more added bonus functionality which makes users feel it is worth the money spent and because more and more people are taking to fitness route. It has become a major influencing factor for users to adopt smartwatches. Insurance companies, educational institutions and other workplaces have been encouraging and providing incentives to their clients and employees to keep fit while using these fitness trackers as a measurement. So having fitness apps and trackers built into a smartwatch is definitely an important motivation for users to buy smartwatches.

Also smartwatches were expected to be sturdy as they go right on the wrist to be more durable. Product life was linked to value for money as the longer the device was in use the more the users felt they got their money's worth out of the device. That being said, weight and design were also important for a smartwatch. Therefore, a sleek yet sturdy design is what is going to sell in smartwatches.

5.2.3. Student and Working Groups. The student group consisted of 15 subjects who were 9 male and 6 female undergraduate and graduate students in the age group of 19-25 years and the working group consisted of 10 subjects who were 4 male and 6 female university staff in the age group 26-50 years old. Both groups were analysed separately and in our interviews we found major differences in the way that each group of people linked the consequences to personal values. The major dissimilarities lied in the values for the two groups. For the student group more focus was on the value for money that they saw from a product. And even though few working group subjects arrived upon value for money to be an important personal value laddered to some consequences they mentioned teaching values to kids to be the actual important personal value (value for money in this case). Similarly, efficiency and saving time were also linked to family value, stating that more efficiency meant more free time which in turn meant more time to spend with family, thus suggesting family value to be one of the most important value for the working group of subjects whereas value for money is to the student group.

Also, another interesting pattern that was found in the student group with respect to the working group was that the student group has a longer wish list or more number of expectations from both the smart wearable devices while the working group mostly had a specific set of factors that they were expecting from a wearable device and when those expectations were not met, they would not adopt the device. The results are very interesting because we now know and learn that it is harder to please the working subjects with new features in place of their original expected features but it is less of the case for the student group as they have trade-offs for some factors in mind which they are willing to replace for more new features. This could also be related to the findings that for the student group, new technology (tech novelty) was an interest or passion in itself (refer to Figure 5.2 and Figure 5.6) whereas for the working group new technology (tech novelty) was linked to professionalism and an opportunity to be on par with their colleagues at work or to even to gain respect and improve image. (refer to Figure 5.7)

6. LIMITATIONS AND FUTURE RESEARCH

As mentioned in the earlier sections, although there are a number of established models for adoption of technology, there has not been much research done specifically in the adoption of wearable technology. Hence, this research makes a contribution in filling this gap in the literature.

Also, for this study, the data was collected from students and staff of a mid-western university; hence, the sample may not necessarily be representative of the user group of wearable technology. Collecting and analyzing demographic data for this study might also be interesting and a nice extension of this study as factors such as age, gender etc. might have an effect on the ladders and the attribute-consequence-value linkages. Other factors such as cultural background might also be relevant moderating variables in this research.

Using only two different smart wearable technologies - Google Glass to represent smart glasses or heads up and head mounted displays and Sony Smart Watch to represent smartwatches - is another limitation. Investigating more technologies and devices in future studies will make the findings more representative of the range of smart wearable technology in the market. The subjects had limited or no experience with smart wearable devices that were being used to understand the factors. If the users were more experienced with the devices used, the insights might have been more rich and useful. Also, having subjects who use these devices on a daily basis would also help to gather more complete perspective of the findings.

7. CONCLUSIONS AND IMPLICATIONS

From our findings we understand that the factors that influence the adoption of wearable technology differ for different wearable devices and also differ for different user groups – student group and working group. These findings along with the linkages to personal values and some new constructs for adoption of smart wearable technology which were not found in the previous literature for adoption of technology are some of the major contributions of this study. Some of the new constructs, in the form of factors that specifically influence the adoption of smart wearable devices, that we found in this study are Fitness Apps – Applications that can track health data, Notifications – Notification panel which shows all the notifications on the wearable device without having to pull out the phone every time, GPS – navigation, maps and location services, GPS accuracy – accuracy and reliability of GPS services, Waterproof – Waterproof and water resistant feature for smart watches to improve product life, Internet Access – Access to the world wide web and Handsfree – being able to use the wearable device without touch or tap functionality i.e. through gestures, voice recognition etc. These are some of the important factors that influence the adoption of smart wearable devices particularly.

Some constructs were also carried over from previous literature like performance expectancy and effort expectancy from the Unified Theory of Acceptance and Use of Technology (UTAUT) which are similar to perceived usefulness and perceived ease of use in TAM, these constructs relate to functionality, ease of use and usefulness in our findings. Social influence was a construct in the previous literature which is closest to the link of look and feel to the personal value Image that was found (refer to Figure 5.1)

Along the lines of how TAM lays importance on Perceived usefulness and perceived ease of use (usefulness and ease of use respectively in our findings) in the adoption of technology we found some other constructs like aesthetics, efficiency, time saving, and dependability to be equally important constructs which influence user decision to adopt smart wearable devices. Look and feel linking to aesthetics and the personal value Image are some constructs that might be specifically important for wearable device Smart glasses in particular as such might not be found in a model like TAM. Also using the laddering methodology has helped us understand not only the constructs but also the linkages and how these factors or attributes map to personal values in the user’s brain.

Therefore a lot of new constructs and new relations as to how users map these constructs to personal values were found, which the literature does not provide, thus proving that the models for adoption of technology do not fully justify all the areas for adoption of smart wearable technology.

From an industry point of view one major takeaway is the difference in expectations from working and student group and also the smart glasses and smart watches. For smart glasses the look and feel was the most mentioned while for smart watch fitness apps were the factors that influenced the users decision to adopt smart watches. In conclusion, the methodology used to understand the factors and the linkages to core values worked out very well. The maps from the results answer the research question, giving us an understanding of what factors influence the adoption of wearable technology and why. This study is one of the first few efforts to understand the adoption of wearable technology and we hope that this lays a foundation for future studies on wearable technology adoption.

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