

스마트 의류의 인식과 수용에 관한 질적 연구 :  
56세 이상 여성을 대상으로\*

The Qualitative Study for User Needs and Acceptance of Smart Clothing:  
Focused on Women Aged 56 and Over

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<Abstract>

By definition, smart clothing describes a garment whose functionality is enhanced by technological advancements in order to ease one's lifestyle. To know user's understanding and needs, the research had consisted of brainstorming sessions, personal interviews, focus group meeting, and a series of content analyses. Ten of the interview subjects and focus group panel were found by contacting women aged 56-64 in the Ithaca community, NY. They were prompted with general questions on style choices for their lifestyles and age group and then presented with two examples of smart clothing to discuss and critique. Meanwhile, the other three interview subjects, located outside of the Ithaca community, were aged either above or below the targeted bracket. These subjects were interviewed as a method of comparison on multiple levels. Findings had shown that there was indeed a need for smart clothing

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amongst the increasingly populated demographic of older women: devices to help one's body temperature regulation and vision problem, and well-designed clothing. However, the functionalities must be carefully constructed and conveyed in order to be taken seriously by the mainstream consumer market. Once successfully designed, the smart clothing will ideally create a greater sense of autonomy for older women.

스마트 의류란 생활전반에 편의를 도모하기 위하여 기술이 접목된 기능성이 있는 의복이다. 소비자의 인식과 필요성을 알기 위하여 브레인스토밍, 개인면접, 포커스그룹미팅, 그리고 콘텐츠 분석을 실시하였다. 10명의 인터뷰 면접자와 포커스그룹 패널은 뉴욕 이타카에 거주하는 56세에서 64세의 여성으로 구성되었다. 라이프스타일 및 연령에 따른 의생활 질문으로 자극을 한 후, 2개의 스마트 의류견본과 더불어 주제에 따른 토론과 분석을 하도록 하였다. 또한 보다 다양한 수준에서의 비교를 위해 이타카 지역 밖에 거주하는 타겟 연령대에 근접하는 3명에 대한 개인 인터뷰도 진행되었다. 본 연구의 결과에서 노년 여성들의 스마트 의류에 대한 필요성은 확연하게 나타났다. 즉, 노화에 따른 시력저하 및 체온조절을 위한 디바이스가 요구되었으며, 의생활에서는 체형변화를 감안한 피트성이 높은 미적인 디자인을 요구하였다. 그러나, 이러한 기능성 디바이스들은 반드시 신중하게 구성되고 수행되어야 할 것으로 나타났다. 성공적인 디자인으로 개발만 된다면 스마트 의류는 노년 여성의 자율성 증진을 이상적으로 야기할 수 있을 것으로 사료된다.

**주제어(Key Words):** 스마트 의류(smart clothing), 노년 여성(older women), 개인 면접(personal interview), 포커스 그룹 미팅(focus group meeting)

## I. Introduction

As the elderly population is rapidly increasing in the United States, many different types of environments and systems geared towards the older group of people are being explored and developed. Wearable technology is one area that has potential to enhance elders' quality of living. An example of smart clothing is snow suits embedded with adjustable heating systems, emergency alarms and global positioning system receivers. In some cases, the fabric of the clothing can function as the smart component for example socks that prevent foot odor by inhibiting bacteria growth (Cornell Chronicle, 2003).

With the growing acknowledgement of the importance of user involvement comes a growing recognition of the importance of involving older users in the research and development of new assistive technologies. This has led to the proposition that older people should be involved in their design and evaluation (Seale, McCreadie, Turner-Smith, & Tinker, 2002).

Marzano (as cited in Ariyatun, Seale, McCreadie, Turner-Smith, & Tinker, 2005) notes Smart Clothes are designed to sense user requirements and environmental contexts, and provide appropriate service at the right time and place accordingly, with minimum effort required from the user to operate.

Thus, this study aimed to identify user's understanding and needs for smart clothing development focused women aged 56 and older. We hope the results of this study would be a good information that explores how garment-integrated wearable technology can be designed to empower older women is a way that also women's aesthetic expectation.

### 1. Purpose

To define the specific need for technologically advanced apparel by women going through age-related physical and life changes.

### 2. Hypothesis

1) Women of all ages and walks of life appreciate aspects of clothing that make everyday activities more manageable, particularly those with age-related physical issues. By focusing on women aged 56-64 years, we will find that subjects will demand functional benefits of clothing that help maintain internal heat patterns, and vision in dim lighting. 2) Unfortunately, these women feel apprehensive towards current advancements in technology. If we make such functionalities more inviting by design, they will become smart clothing consumers.

## II. Method and Procedure

To identify understanding, interest, the needs of the target user, and the problem situation about the smart wear, we conducted brainstorming sessions, personal interviews, and a focus group meeting.

### 1. Brainstorming session

To identify problems for elders, brainstorming sessions were conducted on September 2007 with three elders and five apparel students, and designers and on September 2006 with eight elders and thirty apparel students and designers. Eleven elders were local senior citizens, Ithaca, NY.

### 2. Personal Interviews

#### 1) Subjects

We conducted interviewing ten women the ages of 56 and 64, two subjects over 65 years, and one younger than the age group. The data of interviewees from aged 56 and 64 who lived in the Ithaca community were analyzed for the target user and the other three interview subjects, located outside of the Ithaca, were interviewed as a method of comparison on multiple levels. The majority of subjects were chosen because their age implies physical proximity to symptoms of Menopause and extreme age-related changes. Subjects who participate in the personal interviews were relatively high educated and professional. The average age of them was 63 (see Table 1).

#### 2) Questionnaire

The questionnaire was designed according to the four issues it addressed: (1) General Information and life style: few demographic questions, activities, and

environments. (2) Vision, use of heating device: trouble seeing in some circumstance, having muscle aches and pains, using devices, and regulation of body temperature. (3) Questions about clothing: own style, jacket preference, and priority related to clothing for herself or their age group. (4) Smart clothing: recognition the term of smart clothing, interest in examples of smart wear, functional issues, and vision of the future. Most of the questions were the form of a semi-structured questionnaire and used daily words.

#### 3) Procedure

At the interview, the purpose of the research was explained. During interviewing, some pictures of smart clothing were shown to be easy to understand the questions. The interviews were conducted at the university laboratory from December 2007 to January 2008. The total time for participating in the interview was about 45 to 60 minutes depending on interviewee.

#### 4) Data collection and analysis

The interviewer took a brief summary and the assistant wrote and recorded all of conversation with their consent. Researcher and one research assistant analyzed the data.

### 3. Focus Group Meeting

#### 1) Subjects

After the interview responses were quantified, a focus group was held in February 2008 with ten subjects within the majority age range, the ages of 56 and 64. The samples of the group were a mixture of five personal interviewees and five new participants. The average age of them was 62 and house income was from \$20,000 to \$100,000 and over. One participant was retired and the

Table 1 General information of interviewees

(N = 10)

Age	56-59(5)			60-64(5)		
Income	\$30,000-\$39,000 (1)	\$50,000-\$59,000 (2)	\$60,000-\$79,000 (1)	\$80,000-\$99,000 (1)	\$100,000+ (5)	
Profession	professional (5)	upper management(1)	middle management(1)	proprietor (1)	assistant (1)	part time (1)
Education	Associates(2)		Bachelor's(4)		Master's(2) Doctorate(2)	

( ) indicates the number of respondents

Table 2 General information of focus group subjects

(N = 10)

Age	56-59(4)			60-64(6)		
Income	\$20,000-\$29,000 (2)	\$30,000-\$39,000 (2)	\$50,000-\$59,000 (2)	\$60,000-\$79,000 (1)	\$100,000+ (3)	
Profession	professional (2)	upper management(1)	middle management(2)	assistant (3)	retired (1)	part time (1)
Education	Associates(4)		Bachelor's(2)		Master's(3)	
					Doctorate(1)	

( ) indicates the number of respondents

rest of them had an occupation. All of them were relatively high educated (see Table 2).

## 2) Procedure

Before starting a group discussion, the researcher explained the purpose of the focus group meeting and topics. The focus group was asked to discuss. It started from general affairs and was extended to the research theme their activities, environments, usage of technology, preferred jacket styles and their thoughts on the several proposed prototype smart wear. Two types of smart clothing, lighting cap and thermal vest, were proposed to wear for in-depth discussion and observation. All two investigators attended focus group and were led by one of the investigator who had previous training and experience with focus group methods. The investigator used spontaneous, probing, follow-up questions to explore important emerging issues. Focus group meeting was conducted at the university conference room and lasted approximately 2 hours.

## 3) Data collection and analysis

All of conversation was recorded with their consent. Also we prepared the blank sheet to write their comment. A transcript of the focus group meeting was made and then analyzed through a content analysis of the open coding, axial coding procedures which were proposed by Strauss and Corbin (1990) originally, and discussion with researcher and two research assistants. From the data, phases were derived as they were identified, and categories were developed to organize the phases into meaningful clusters, and detailed descriptions were written for each category. Two members of the research team content analyzed the data for broad similarities and differences. Discussion

occurred until consensus was reached. A total of 12 categories were determined based on user's needs for clothing and smart wear. While some of the categories provided general insight to the subjects' overall values in clothing, others pertained specifically to smart clothing.

## III. Results

### 1. Problems identified for elders

The results of the brainstorming sessions, showed there were common problems in regulation of body temperature and vision: 1) body temperature regulation e.g. cold feet, etc.; co-sleeping temperature preference; hot flashes; vision problems e.g. threading a needle, etc. from brainstorming session 2006. 2) vision impairment; readings; temperature sensitivity; safety in the dark or winter from brainstorming session 2007.

### 2. Interviewees' needs and understanding

#### 1) Life style

User was aged 56-64 years of age, a range of women who were likely employed empty nesters with the physical capabilities for an active lifestyle.

#### 2) Vision, use of heating device

During interviews, subjects were asked about their age-related physical discomfort, specifically if they had aches and pains, internal heating irregularities, or loss of vision. All subjects except 2 women had problems on vision or temperature regulation and use some devices to cure. When referring to aches and pains, subjects usually described personal circumstances, such as recent injuries or genetic tendencies. For instance, one subject had osteoporosis, which was the cause of her aches and

pains. However, on the whole, these aches were most commonly in the lower back region. These aches more commonly caused a subject to need heating pads than thermo-regulation issues themselves. This result is explained by the fact that aging subjects are unusually warm more often than they are cold, perhaps because of menopausal reactions. As for vision, most complaints had to do with lighting, as subjects commonly referred to driving at night as being an age-related apprehension. To adhere to our purposes, a dimly lit room is the primary issue when reading.

### 3) Clothing preference

Most of them were very active and seems to like professional jacket and outdoor jacket. Relatively they liked relaxed silhouette and hip length even though their favorite jacket styles were various.

While these women varied in aesthetic preferences, they all shared one apparel priority: fit. The second most emphasized factor was versatility, meaning the ease of wearing one garment for multiple occasions. For each subject interviewed, the extent to which clothing fit is flattering was the most heavily weighted factor in a garment's value.

Meanwhile, the value of functional clothing was not a common consideration. After fit, versatility was the most commonly used term for an apparel priority. In other words, while added functions were expectedly seen as valuable, subjects actually saw them as price enhancing aspects of apparel, which would make a staple blazer into a novelty item. However, all women appreciated the

functions themselves. About half of the subjects even claimed that they carried around portable lighting devices. Also the results of interviews showed they would willing to pay more for function definitely (4 respondents), only some function and good fit (4 respondents), and so long as it is a good fit (2 respondents).

Table 3 Clothing preference

Clothing priority	Life style priority	Age group priority
Comfort (7)	Versatility (5)	Aesthetic design (6) (Looking appropriate)
Flattering/fit (5)	Comfort (4)	Fit (6)
Style/aesthetic (2)	Functional (3)	Comfort (3)
Color (2)	Presentability (2)	Warmth (2)
Functional (1)	Durability (1)	Bargain (2)
Appropriate fit (1)		Longevity (1)

( ) indicates the number of respondents

### 4) Smart clothing

They had relatively low perception but considerably high interest in smart clothing. 60% of the samples had not heard of smart wear and 40% of them said just knew of the term of smart wear but didn't recognize it exactly.

From an aesthetic standpoint, some women felt it was unnecessary and somewhat obtrusive to everyday lifestyles. The subjects who were more averse to smart clothing were those who claimed strong personal styles, and further coined these looks as "classic" and "tailored." These traditional yet style-conscious women, however, were easily swayed by the statistical prediction that 40 percent of their age group will be purchasing

Table 4 Users' interest in smart wear products

Smart wear examples	subject 1	subject 2	subject 3	subject 4	subject 5	subject 6	subject 7	subject 8	subject 9	subject 10	mean
Illuminating raincoat	4	3	4	5	3	4	1	4	5	1	3.4
GPS vest	5	2	4	5	4	4*	4	2	1	1	3.2
Thermal outdoor	4	4	5	4	4	5	5	2	5	5	4.3
Health vest	2	5	5	4	4	5*	5	4	3	1	3.8
Phone jacket	4	2	3	4	3	3	1	1	5	1	2.7
Alerting suit	1	2	4	3	4	4	3	1	5	1	2.8
Picture necklace	3	3	3	4	4	4	1	1	2	1	2.6
Jacket with computer	2	2	5	5	3	5	2	3	5	1	3.3
Protect pants	3	2	4	4	5	4	3	2	4	1	3.2
Interest in smart wear	3	2	4	5	4	5	4	3	5	3	3.8

(Extremely interested 5--4--3--2--1 not at all)

\*: subject found this garment appropriate for a different age group

smart clothing by 2010. In other words, feelings towards smart clothing are currently a matter of personal taste, but consumers will become more trusting once smart clothing becomes a trend.

Once subjects could open their mind to the idea of smart clothing, they saw the demand for it. They tended to see such innovation most needed by the older generation.

According to Table 4, it can be seen that they had a most interest in thermal outwear product for heating for cold weather. The following items were health vest can record blood pressure, pulse, temperature and etc. and raincoat that lights up in the rain.

Considering the user, women aged 56 and older, we proposed some future tentative design of smart wears for them to know their preference: *Jacket with a built in electric shock device for user for self-defense, A jacket with auto lighting to help the wearer see, Vibration jacket to massage a stiff shoulder, neck, or back, Thermal clothing for therapeutic heating for shoulder, abdomen, back waist or joint area, and Shirt or blouse that alerts the wearer to take their pills using a vibration device.* The results revealed that they wanted thermal function to help their temperature regulation or therapeutic heating (see Table 5).

The added functions influence a price increase and the price is one of the issues for smart clothing. Except two

subjects, they all agreed that smart wear is useful and were willing to buy a smart clothing even though it offered pay 10 ~ 25% more (see Table 6). They gave a specific reason to purchase for its function (9 respondents), convenience (3 respondents), individuality (1 respondent), necessity (1 respondent), availability (1 respondent), and as a gift (1 respondent).

Considering their concerns about smart wear, as Table 7 shows, weight of the device was biggest issue and users were worried if the garments look odd. Therefore, smart wear for elderly should be considered not only function but also appropriate design for them.

An interesting turn of results was found as we looked to other age ranges. For instance, subjects were aged 86 and 80, respectively, responded apprehensively to all of the given smart clothing examples. Unfortunately, they are the characters who subjects aged 56-64 saw most in need of the functions that smart clothing offers. While one of the older first seemed excited by the idea of smart clothing, asserting that every woman in her elderly neighborhood would embrace the concept, she changed her mind once posed with specific examples, because she thought of having to control the functionalities herself. In other words, she acknowledges the need for smart clothing, particularly amongst women her age; however, she was not keen on any activity required by the consumer.

Table 5 Users' interest in future smart wear design for elderly

Future smart wear design examples for elderly	subject 1	subject 2	subject 3	subject 4	subject 5	subject 6	subject 7	subject 8	subject 9	subject 10	mean
Self-defense	3	2	5	5	4	3	4	3	5	1	3.5
Auto-lighting	4	4	3	4	3	3	2	3	5	1	3.2
Vibration	4	4	5	2	3	4	4	1	4	1	3.2
Thermal	4	4	5	3	4	5	5	4	5	1	4.0
Alerting device	3	3	5	3	3	4*	4	1	5*	1	3.2

(Extremely interested 5--4--3--2--1 not at all)

\*: subject found this garment appropriate for a different age group

Table 6 Users' acceptance of smart wear

Smart clothing	subject 1	subject 2	subject 3	subject 4	subject 5	subject 6	subject 7	subject 8	subject 9	subject 10
Is it useful?	5	2	3	5	4	5	5	1	5	4
Buying? Offered pay increase?(% more)	3	1	3	*	2	4	**	1	5	4
	10~15	no	20~25	20~25	10~15	15~20	20~25	no	20~25	20~25

(Definitely 5--4--3--2--1 not at all)

\*: depends on price

\*\* : if it makes her look nice and keep her shoulder warm

Table 7 Potential issues of smart wear

Potential Issue	subject 1	subject 2	subject 3	subject 4	subject 5	subject 6	subject 7	subject 8	subject 9	subject 10	total
Garment care				1	1	1		3		3	9
Price				1		2					3
Weight of the device		2	3	1	3	3	3				15
Mobility			2								2
Low use value		1						2	2		5
Thermal management	3				2						5
Flexibility				2	1		2				5
Durability/longevity	2								3		5
Size and fit	1		1	1			1				4
Garment looks odd	1	3	1	3			1		3		12

(3: 1st choice, 2: 2nd choice, 1: 3rd choice)

If smart clothing is demanded by a user's relative, but the user herself is not comfortable with the product, then who is our market? Perhaps such advanced technology is applicable to the elderly age group, but more accepted from a different cohort. Looking at the interview with younger subjects, specifically another subject, aged 51 years, we see less apprehension towards smart clothing. Although this subject was personally averse to the idea of clothing with embedded functions, she admitted that her friends and other members of her generation would be comfortable with such a movement. She admitted that her age group (aged 45-56) would embrace the thermo-regulated functionalities in order to manage Menopausal heat flashes. The preferences for versatility and aesthetic design take reign over such extensive functions; however, the Subject was receptive to the idea.

### 3. Content analysis

#### 1) Looks

The women said that when they look good, they also feel good. This suggests that appearance of a garment has a strong influence on how the wearer feels about herself when she puts it on. The women frequently mentioned 'good colors,' 'good materials' and 'good design and construction' as some of the qualities that contribute to the notion of good looking clothing.

#### 2) Fit

Fit was frequently mentioned in response to the question that asked about clothing that made the subjects

feel good. This suggests that, along with the other qualities previously mentioned (colors, materials and construction), clothing fit is an important consideration. The ability to body scan for perfect-fitting was also brought up. The women showed interest in body scanning that would help them create customized-fit clothing. They also wished that there was a way for them to take the well-fitting clothing they currently own to a seamstress/business so that a duplicate could be made. These opinions all testify to the importance of fit. One woman expressed interest for stretch in garments; this communicates that flexible clothing that can accommodate some small changes in size may be important.

#### 3) Versatility

The women considered versatility very important. Whether they could wear the garment with different items was an important consideration that affected their purchasing behavior. Also, the ability to dress the garment up or down depending on situation was another frequently mentioned point.

#### 4) Economic/Opportunity

Price was another factor that affects older women's buying decision. When women purchase a garment, they think about whether they enough opportunities or occasions for which to wear this piece of clothing, and see if the price is appropriate. If the price is high and there are not many opportunities to wear it, then the clothing will not be as attractive in terms of economic value.

## 5) Comfort

Comfort was one of the most significant factors that the women looked for in clothing. One person even preferred comfort over style. Comfort also was related to producing feelings of happiness. Some examples of uncomfortable clothing and shoes included high heels and nylon pantyhose that bothered skin. It is evident from these comments that ergonomics is closely associated with people's sense of comfort. Ergonomic products that do not put stress on different parts of the body will be considered more comfortable.

## 6) Sustainability

As an unpredicted topic of discussion, the issue of sustainability took precedence over many other concerns. The vocal majority of this focus group spoke passionately about their concerns for the environment. Although these women are from an area where the local majority prioritizes environmental friendliness, this issue may not be as prevalent in the mainstream market. However, as one woman said, it is important to take sustainability in consideration because it has become a more frequently raised issue these days. In addition to environmental conservation, the women also noted that they would like to support socially responsible businesses that protected the natural environment and treated their workers in an ethical manner. This implies that the process by which clothing is important as well as the product itself.

What was prevalent was the interpretation of sustainability as longevity. As one subject stated, "I don't think anyone wants any more products that are throw-away; at least not in this community." And another said, "You certainly don't want to have to pay a lot for something you're going to have to throw away. Women, particularly in this age-group, look at each purchase as a long-term investment, and prefer items that have long life spans.

## 7) Choice/Freedom

These women cherished the ability to have autonomy in dress. Their active lifestyles required control over the functions in their apparel. As a result, many women wanted to know the specifics of charging each piece of

smart clothing. They wanted to feel comfortable in a classic garment with a flattering fit, so they could pair it with any outfit. Along these lines, subjects expressed a need for options in color, fit, and other aspects related to aesthetic, for a given garment. They preferred taking a piece and incorporating it into their specific lifestyles, rather than being limited to available trends.

## 8) Balance/Combination

Most women expressed a preference for a balance between various elements of a garment. Everyone wanted to "look and feel good" however, for purposes of simplicity, we would categorize responses within specific elements. It was interesting to note that one woman when she was referring to her experience of wearing a garment that looked but was not suitable to the activity in which she was involved; she blamed the misfit on her body rather than on the clothing.

## 9) Age-related changes and preferences

Age-related changes and preferences can be sub-categorized as physical and behavioral. As these subjects had aged, they had noticed themselves losing control over vision, feeling strong discomfort in the hips, and accumulating arthritis in the fingers. Therefore, each of these subjects supported glare retention, heated garments for sore joints, and bigger buttons, respectively.

In addition to personal changes, all women agreed on their matured consumer behaviors. They no longer spend money as frivolously as they did when they were young adults, nor are they as intrigued by new technology for the sake of being new. Instead, they preferred to align their expenses with appeasing such physical needs. As one subject stated, "13-30 year olds would go wild for this stuff."

## 10) Lifestyle and situational effect

The style of women at any age can be determined by individual situations and lifestyles. For instance, one woman worked in construction, and she continuously referred to the need for comfort and durability; however, these needs changed when the question was posed to the librarian. Moreover, one woman even searched for jobs depending on attire expectations.



Table 8 Key categories from focus group analysis: user's need for clothing

Category	Consensus	Ideas/opinions emphasized by one or two subjects
Looks	<ul style="list-style-type: none"> <li>-Colors</li> <li>-Good materials</li> <li>-Well designed</li> <li>-Good fabrics</li> <li>-Looks good related to feeling good</li> </ul>	<ul style="list-style-type: none"> <li>-Reversible</li> <li>-Patterns</li> <li>-Colors work together</li> <li>-Well-constructed sewn properly</li> <li>-Makes me look skinny</li> </ul>
Fit	<ul style="list-style-type: none"> <li>-Fits well (makes me feel good and look smart)</li> <li>-Body scanning for fit</li> </ul>	<ul style="list-style-type: none"> <li>-Fit (difference of fit in old and young)</li> <li>-Vest: "It looked different on everybody because were shaped differently but it looked quite nice."</li> <li>-Stretch in garments</li> </ul>
Versatility	<ul style="list-style-type: none"> <li>-Can wear with different things</li> <li>-Dress up or down</li> <li>-Would prefer a bra (versatile aesthetic)</li> </ul>	<ul style="list-style-type: none"> <li>-Goes with black pants and black skirts</li> </ul>
Economic/ Opportunity	<ul style="list-style-type: none"> <li>-Reasonable price/ Bargain price</li> <li>-Occasion (regular v. one time)</li> </ul>	<ul style="list-style-type: none"> <li>-Do I have sufficient opportunities to wear it?</li> <li>-Frequency of wearing: should be able to wear it whenever</li> <li>-How long it stays fashionable</li> </ul>
Comfort	<ul style="list-style-type: none"> <li>-Comfortable</li> <li>-Comfort</li> <li>-Comfort and functionality</li> </ul>	<ul style="list-style-type: none"> <li>-High heels are uncomfortable</li> <li>-Nylon pantyhose bothered skin</li> <li>-First comfort and then style</li> <li>-Comfortable shoes makes her comfortable and happier at work</li> </ul>
Substantiality	<ul style="list-style-type: none"> <li>-Reusability</li> <li>-Substantiality: why not just use natural material?</li> <li>-Comfort- environmentally ethical (socially responsible businesses)</li> <li>-Replaceable Batteries</li> <li>-Sensor-operated heat patterns</li> <li>-Longevity</li> </ul>	<ul style="list-style-type: none"> <li>-Green jacket- solar powered</li> <li>-Alternative energy</li> <li>-Rechargeable Batteries</li> <li>-Polar Tec Fleece</li> </ul>
Choice/ Freedom	<ul style="list-style-type: none"> <li>-Depends a lot on your body type</li> <li>-Don't want to be limited by trends/ current fashion</li> </ul>	<ul style="list-style-type: none"> <li>-Buying the same clothing in different color</li> <li>-Making my own pattern</li> </ul>
Balance/ Combination	<ul style="list-style-type: none"> <li>-Combination of things that look good and feel good</li> <li>-Balance of all elements (fit, comfort, aesthetics)</li> <li>-Something looks good but not ideal for your work activity</li> </ul>	
Age-related changes and preferences	<ul style="list-style-type: none"> <li>-Glare</li> <li>-Makes me conscious of how I look because my body has changed</li> <li>-Older people not as active compared to when they were young and can get cold easily</li> <li>-Sensible buying with age</li> </ul>	<ul style="list-style-type: none"> <li>-get old they start to lose their eyes</li> <li>-lower shoulders</li> <li>-Physical changes due to aging</li> <li>-Hip joint pains</li> <li>-Fingers become more arthritic</li> <li>-Fit (difference of fit in old and young)</li> </ul>
Lifestyle and situational effect	<ul style="list-style-type: none"> <li>-Dress style changing by what job you have (where you work and with whom you meet)</li> <li>-Tastes in clothes don't change because it is related to personality and style even though some more trend-based</li> <li>-Societal changes</li> </ul>	<ul style="list-style-type: none"> <li>-Choosing career based on dress code</li> <li>-Comfort and durability in field/ nicer clothes in meeting</li> <li>-Psychological effect</li> </ul>

### 11) Interest in smart clothing

Everyone could find a place for smart clothing in their individual lifestyles. However, they all differed in situational needs. Smart clothing seemed more accessible to these women when presented as active-wear, though they did see a place for it in everyday social and professional activities. The women also showed concern

for seasonal changes that may affect how they wear would smart clothing, specifically. For example, on a summer day, it is not likely that they are going to wear a smart jacket with a heating capability. For versatility reasons, it is important to take this into consideration when designing smart clothing.

Many of the above suggestions were based on

Table 9 Key categories from focus group analysis: user's need for smart wear

Category	Consensus	Ideas/opinions emphasized by one or two subjects
Interest in smart clothing	<ul style="list-style-type: none"> <li>-Good in cold weather</li> <li>-Wear it under something else</li> <li>-Versatility with respect to season change</li> <li>-Get it for others (mother, sister, father)</li> <li>-Make it lightweight</li> <li>-Would be interested in cooling aspect (four a 5 year younger age group)</li> <li>-Stylish added to functional</li> <li>-Body scanning for fit</li> </ul>	<ul style="list-style-type: none"> <li>-How long it takes to heat- feedback</li> <li>-Wear it to work</li> <li>-Wear it walking</li> <li>-Good: want to warm up my stiff muscle (not a matter of warm versus cold)</li> <li>-Pockets in right places/ zipper</li> <li>-Sun protective</li> <li>-Micro-fibers</li> </ul>
Concerns with specific prototypes	<ul style="list-style-type: none"> <li>-Noticeable effects ("where are the heated areas?")</li> <li>-Ease of wearing: e.g. One on/off button</li> <li>-Safety precautions e.g. getting wet, pace maker</li> <li>-Precautions for elderly: knowing when to it take off</li> <li>-Ease of wearing/time to heat</li> <li>-"smart" device (automatic sensor)</li> <li>-LED lights</li> <li>-Better as a visor</li> <li>-Ability to aim</li> <li>-Light intensity</li> </ul>	<ul style="list-style-type: none"> <li>-Adjustability in heating</li> </ul>

personal interests(i.e. UV protective, micro fibers); however, everyone strongly supported any smart means of producing 'better fitting' garments. Further, many women could see themselves purchasing smart clothing for their parents who are physically and mentally less capable of taking care of themselves.

#### 12) Concerns with specific prototypes

The primary concern with smart clothing, as brought up in reference to the proposed prototypes, was that of garment care and maintenance. First, many found the set-up of the vest far too complicated. They would prefer a single on/off button, which does not take time to charge. All would like a grab-and-go feel to their clothing so that they could wear such garments spontaneously.

On another note, these women would all hesitate to actually purchase these garments for an older generation, because of the safety precautions of technologically advanced clothing. For instance, one woman asked if she would become electrocuted in the rain. Others agreed with laughter intertwined.

Lastly, these functions must be applicable to the activity at hand. For instance, all women who tried on the light agreed that the LED lighting on the hat should be adjustable to aim at anything from a book to a sidewalk.

One woman was skeptical with how electronic

components will be implemented into clothing such as a tailored jacket that is not an active-wear without creating bumps. Emphasis was placed on the smart features not taking away from the flattering affect of a garment.

In regard to the heating aspect, some mentioned interest in thermo-statically controlled technology that would sense and automatically keep the body temperature at a certain level. This was important since one woman reported that it may be difficult for some elders to sense whether they were being heated or not. This relates to the age-related effect of sensory defect that elders experience and indicates a need for sending feedback to users in multiple ways (e.g. a button that lights up when heat is on so that those who cannot sense heat can know that they are being heated). Also, the women indicated that they should be able to start/use the jacket with ease without referring to a long instruction manual.

## IV. Conclusion

This study made mainly use of interviews and focus group as means of gauging user interest in smart clothing. Both interviews and focus group were types of qualitative research methods. Although these methods have limitations in that they are not suitable for studying

a large sample representative of the general population, they are valuable in terms of providing the researchers with opportunity to probe an elicited detailed responses. In our case, with the small number of participants we were able to recruit for interviews and the focus group, we were able to draw insightful knowledge about older adults' views on wearable technology.

In response to the subjects' age-related physical changes, a thermo-regulated jacket was undoubtedly needed by the targeted demographic. However, much to negate the hypothesis, this demand was due to aches in the back, rather than actual feelings of being cold. Most subjects felt that they were cold, but assumed that this feeling was in tandem to the younger people in their presence. Either way, the thermo-regulation aspect of the blazer could be placed on the small of the back, because that was where the material would hug the wearer anyway. Further, another heating pad could be placed on the top of each shoulder in order to provide warmth if needed, and discretely excused the demand for a shoulder pad. Informal questioning had shown that shoulder pads were in definite demand by the cohort at hand. Unfortunately, whether this trend is age-related or cohort-dependent is ambiguous.

While price was not commonly stated as a primary concern, the priority of versatility indicated that all subjects wanted to maximize the usage of any garment they own. As a result, they feared that a blazer with embedded functionalities would make the jacket actually lose value. If the jacket's electrical energy were not sustainable through time, or if the added functions influenced a price increase, they would not purchase it.

A change in product form can compensate for pricing issues. In order to adhere to the common value of versatility amongst subjects, we could make certain 'Smart' aspects of the jacket dispensable and applicable to other garments. For instance, the jacket could have detachable cuffs embedded with LED lighting. As a result, the cuff could be used on the original blazer or as

a bracelet in itself. This idea was actually inspired by Subject Ten's suggestion for Smart Accessories, such as a fashion-forward bracelet with vibrating or lighting effects, to remind users to take pills or illuminate reading material, respectively. Such an accessory or detachable cuff would also ease the apprehensions of women who do not want added functionalities to make their apparel less flattering.

Numerous technologies have been developed to enable designing of intelligent clothing. However, more efforts are required to make these products acceptable for everyday use. From a designer's standpoint, exploring ways to make wearable technologies more aesthetically pleasing and sustainable seem important in encouraging wide usage.

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