



Consumer Interest in Commercial Applications of Body Scan Data

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ABSTRACT

Three dimensional body scan technology is being targeted for utilization in the apparel industry, specifically for automated custom fit, size and fit prediction, virtual try-on, personal shopper services, co-design mass customization, custom pattern development for home sewers, and research. But the ultimate success of commercial applications of body scan data will be consumer acceptance and use of the applications. In this study, we surveyed a sample of 203 women 34-55 years of age about their interest in these six commercial and apparel research applications after they were scanned. The results indicated high interest by over 80% of the sample in virtual try-on, size prediction, custom fit, and personal shoppers. When asked to select the application of highest appeal, virtual try-on was selected by 35% of the sample while custom fit, size prediction, and personal shopper applications were selected by 15-16% each. Women with dissatisfaction with ready-to-wear pant fit, higher incomes, and Internet buyers were significantly more likely to look for and purchase clothing on the Internet if these scan-based applications were available commercially. Recommendations are made for future experimental and focus group research to study how consumer interest in adopting these applications could be stimulated.

Keywords: 3-D body scanning, mass customization, virtual try-on, custom fit, size prediction, Internet shopping, consumer decision making

Introduction

Three dimensional body scan technology is being targeted for utilization in the apparel industry, specifically in the development of automated custom fit, size and fit prediction, virtual try-on, personal shopper services, co-design mass customization, custom pattern development for home sewers, and research. Each of these innovative applications can increase the involvement of consumers with the clothing whether they are purchasing online or in a traditional retail store.

Some body scan applications are already available to consumers. In conjunction with body scan measurements, automated custom fit technology develops clothing designed to fit perfectly on the consumer. Apparel producers are currently applying scan data in this way, most notably Brooks Brothers for custom made suits for men (<http://www.brooksbrothers.com/>). Unique Patterns (<http://www.uniquepatterns.com/>) offers custom patterns for home sewers (women

only) that are developed from personal body scan measurements collected using their scanner that travels to fabric stores throughout Canada and the U.S.

Additional commercial applications of body scan data are also being investigated. Virtual try-on provides the consumer with a computer-generated visual display of how a garment will look on her body. Body scans can be used to virtually try-on or test fit garments to help in the selection of particular styles. This would be similar to the way Lands' End (<http://www.landsend.com/>) is applying technology by using a series of questions to create an image of an individual's characteristic body type and then dressing that image to give customers a 3-D visualization of how clothing looks on their body type. Size and fit prediction uses technology designed to aid the consumer in making the correct purchasing decision by giving the consumer size recommendations for a particular garment brand. The military services are testing the use of body scan measurements of individuals to aid in size prediction (Staples, Davis, & Pargas, 1993). Prediction of brand name and size (of member brands) that best fits an individual's body measurements are being offered by third-party businesses as a B2B service to brand names (<http://www.fitme.com/>). Although these businesses currently use manual measurements, body scan data could also facilitate such size prediction applications. Personal shopper services could use body scan data to provide help in selecting styles most appropriate for an individual's body type and size. This is a particularly appropriate use of scan images that provides clear, realistic images of posture and proportions of the scanned person. Interactive programs on the Internet or in retail stores that allow consumers to make design choices in the creation of a garment, sometimes referred to as co-design and mass customization, could also help in appropriate style and size selection to provide good fit if body scan data were used in combination with the design functions. Mass customization systems have the potential to improve fit while avoiding the

complexity of a custom fit system by offering different lengths or proportions of the same basic style. The recently discontinued Original Spin jeans from Levi Strauss which provided many different combinations of waist, hip, crotch, and inseam measurements is a good example.

The common goal of these innovative commercial applications is to provide the consumer with realistic and helpful information that will facilitate the clothing selection process and achieve satisfactory fit. When used in conjunction with body scanning technology, the ability of these commercial applications to provide consumers with accurate, useful information is increased. However, the potential of these commercial applications is unknown. In fact, current use of body scan data other than for research purposes is minimal. Consumer acceptance is critical in the commercial success of any of these applications. The purpose of this research was to evaluate consumer interest in the various applications of body scan data to assess commercial potential and to describe characteristics of the consumers who expressed greatest interest.

3-D Body Scan Technology

3-D body scanning systems may carry commercial potential in the apparel industry because of the scanner's ability to capture an unlimited number of accurate and reproducible body measurements along with body proportions and posture, to create individualized garments for a wide variety of human bodies, and to automatically incorporate digital measurements extracted from the scanner systems into apparel CAD systems (Istook & Hwang, 2001). In these ways, 3-D body scanning technologies can contribute to the success of custom fit and mass customization as well as other innovative interactions with the consumer. The three-dimensional body scanner is an important new technology for the apparel industry, but use of the tool is in its early stages of development.

Several consortiums have or are currently collecting scans from representative populations of women and men in the U.S. and Europe for the purpose of anthropometric study. The CAESAR project

(<http://www.sae.org/technicalcommittees/caesarhome.htm>) collected population data for automotive, airline, and apparel industries from 2,500 U.S. and European civilians. It served as the model for two other population studies, SizeUK and SizeUSA, which collected body scan data that are currently being analyzed and distributed to business and academic partners in the projects. The SizeUK project intends to make significant strides in integrating body scanning, advanced CAD, and commercial applications to facilitate the production and distribution of custom fit clothing, establish basic body standards, and develop virtual shopping technologies, smartcard applications, and more secure data storage (<http://www.sizeuk.com/>). Technology Clothing Technology Corporation [TC]² is leading the SizeUSA project (<http://www.sizeusa.com/>) with business, industry, and university sponsors. Over 10,000 women and men have been scanned in 13 cities across the U.S. with age, ethnic, and size representation. Along with demographic information, selective measurements will be available to sponsors targeting the population of their choice; for example, a target market of women who are 21 to 35 years of age with ethnicity representative of the U.S. population.

Retailers such as Lands' End and Brooks Brothers have taken initial steps to help consumers find better fitting garments by using customer measurement information to create individualized or custom fit garments. Land's End also offers consumers the ability to visualize their potential purchases using virtual try-on software programs (Wellington, 2001). Abend (2001) described three other innovative businesses that could benefit from the use of scan data. My Virtual Model Inc. (<http://myvirtualmodel.com/>) provides software packages to retailers for consumer online interactive experiences through

virtual try-on, size recommendations, and personal shopper services. Browzwear USA (<http://www.browzwear.com/>) is morphing its Browzwear Avatar with body scan data to develop its "C-Me" 3-D visualization model that will virtually drape and adjust pattern shapes on a variety of body types. ImaginariX.com has developed a Click & Dress program that merges a consumer's photo with a picture of a garment to generate a realistic virtual image of the consumer in the garment. In addition, PAD Systems Technology and Selfridges Bodymetrics (<http://www.bodymetrics.com/>) also offer virtual fit technology. Osma Engineering S.A.S. incorporates 3-D body measurements into automatic pattern modification, virtual try-on, marker making and production (DesMarteau & Speer, 2004).

Companies have also developed commercial applications to predict size and fit based on consumers' measurements. FitMe.com has developed a software application that uses an individual's measurements to predict his/her ideal size and fit across hundreds of different clothing brands. My Virtual Model has also developed technology that combines measurements with garment specifications to recommend the ideal size for the consumer.

Intellifit (<http://www.intellifit.com/>) uses 3-D scanning technology in which the consumer can remain fully clothed while the scan is taken for made-to-measure clothing as well as recommendations of sizes and styles (Speer, 2002).

Other technology developers are working on automatic creation of customized patterns based on 3-D scan data. Lectra Systems (<http://www.lectra.com/>) has developed the FitNet software that facilitates mass customization of style and fit. FitNet allows consumers to choose different styles and fabrics and then adapts garment patterns to consumers' measurements that are captured either from a body scan (in partnership with Human Solutions scanner technology) or traditional measuring. Optitex (<http://www.optitex.com/>) and [TC]² (<http://www.tc2.com/>) worked together to

develop software to enable data from the [TC]² scanners to be applied in developing custom patterns and garments. Optitex offers technology that stitches flat pattern pieces together to see how they fit and drape on 3-D models during the design process.

Research investigating body scanning indicated great interest in the process when consumers read a description of the body scan process and its applications (Fiore, Lee, Kunz, & Campbell, 2001). When participants actually were scanned (Loker, Cowie, Ashdown, & Lewis, 2004) their interest was also extremely positive, though only those people willing to be scanned in the first place participated in this study. With these early studies, we can conclude that the concept and process of body scanning appears to be attractive to many consumers.

The integration of body scanning technology and innovative software applications may influence more consumers to shop for and purchase clothing on the Internet because of the added information available to facilitate the decision-making and purchasing process and the potential for consumer involvement. Consumers are motivated to buy goods on the Internet primarily because it is an easy and convenient method and offers a wide variety of products and prices (Neilson, 1999). Internet technology enables mass customization— individualization through consumer involvement in the process and product. In a study of mass customization and consumer online involvement in design, Kamali and Loker (2002) found that 86% of the college student sample purchased clothing from the Internet because it was convenient and that over half the sample believed shopping via the Internet to be less difficult than mall or mail order shopping. Approximately 35% of the subjects preferred to shop on the Internet because of the wide variety of clothing available and because they were more likely to find what they were looking for (Kamali & Loker, 2002). Another study, with an older, more diverse sample, found that more than 80 percent of Internet shoppers found it

difficult to shop online for clothing because they could not try on the garments and they were distrustful of the on-screen representations of the garments (Abend, 2001). Neilson (1999) found that Internet shoppers tended to purchase goods only 5% of the time when shopping online. Commercial applications of body scanning technology used in conjunction with the Internet might give consumers additional information and the involvement they desire resulting in more frequent clothing purchases on the Internet.

Previous research has focused on body scanning in general and consumer shopping on the Internet. Consequently, little is known about consumer interest in the variety of applications for body scanning that are now being evaluated for commercialization. This study explored female consumers' interest in potential commercial applications of body scan data.

Theoretical Foundation

Schiffman and Kanuk's (1991) model of consumer decision-making was used as a conceptual framework for this study of consumer interest in body scanning applications. The model describes the process consumers follow when making purchasing decisions. External inputs, such as product, promotion, price, and channel of distribution, serve as information sources that affect the consumer decision-making process and eventual purchasing behavior. Consumer acceptance of body scanning applications in the apparel industry may be dependent on related factors such as the fit of the final product, the price of the product and its price relative to other like products, the application process such as the experience of viewing and manipulating scan visualizations with a variety of clothing in virtual try-on, and the accessibility and use of the applications. These external inputs may influence how consumers will evaluate the applications, their interest in using the applications, and whether they would purchase a garment created as a result of being body scanned.

Research Questions

The research questions that framed this study were:

- In which applications of body scan data are women most interested?
- Will the level of interest in specific applications of body scan data vary based on women's personal characteristics and interests?
- Will women who are dissatisfied with ready-to-wear fit be more interested in body scan applications than other women?
- Will women who shop for clothing on the Internet be more interested in body scan applications than non-Internet shoppers?

Method

These data were collected from two samples. The first data set is a part of a larger study investigating the use of body scan data to design sizing systems based on a 34-55 year old, female target market. A sample of 203 female participants were recruited in two locations using newspaper and newsletter articles, presentations at community groups, and social networks. Participants contacted us by phone or e-mail to arrange an appointment time to be scanned at the campus laboratory or at a retail store in New York City where an identical scanner was rented. Participants were required to be between the ages of 34 and 55 and to wear clothing sized 4-16 or 14W-24W. A \$20 incentive was awarded upon completion of the research protocol which included two body scans and a

questionnaire. One important descriptor of the sample was that all participants were willing to be scanned for the research study and therefore this study does not include data from women who were not willing to be scanned.

All participants were scanned twice, once in a Lycra scan suit and once in a pair of test pants chosen for best fit, as judged by the researcher, from pants in two different size ranges (Misses and Women's) provided by an industry collaborator. Following the scanning process, participants were given the option to view their body scan on the computer screen and in a movie file that automatically rotated on the screen. They were offered a disk with the movie file of their scan to take home.

Participants then completed a questionnaire. To introduce participants to the relatively new and unknown commercial applications, the questionnaire included written scenarios describing seven applications of body scan data (see Table 1). Given the innovative nature of these applications, the questionnaire was formatted to allow easy review of the scenarios as the participants responded to related questions. Demographic information and characteristics of shopping habits were also collected. The entire process took an average of 40 minutes, ranging from 30 to 60 minutes, depending upon the number of pants the participant tried on, the number of scans taken, and the time taken in completing the questionnaire.

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Table 1

Body Scan Application Scenarios

Scenario 1

You are at home shopping for clothing online and access a website that allows you to apply **VIRTUAL TRY ON** with one of several retail companies. **VIRTUAL TRY ON** allows you to dress your 3D scanned image on a computer screen to see how a style looks on your body. Because you are using your own body scan data, the image is formed from your personal measurements to give you a more accurate representation of how clothes look on your body. How interested are you in this service?

Don't Know	Not At All		Neutral		Very Interested
0	Interested	2	3	4	5
	1				

Scenario 2

You are given the option online to use your body scan data (containing your exact body measurements) for **SIZE PREDICTION** which predicts the brand that fits you best and the size within that brand that fits you best. This service will provide advice on which size you are according to each company's sizing system and help you choose the brand and size that fits you best. How interested are you in this service?

Don't Know	Not At All		Neutral		Very Interested
0	Interested	2	3	4	5
	1				

Scenario 3

You are shopping online or in a retail store and find that the measurements from your body scan can be used to develop **CUSTOM FIT** clothing made specifically to fit your body. You are interested in this service because the garment is made specifically to your measurements guaranteeing your purchase will fit your body. After the garment is made, the retailer will either mail it to your home or inform you that it is ready to be picked up at the store. How interested are you in this service?

Don't Know	Not At All		Neutral		Very Interested
0	Interested	2	3	4	5
	1				

Scenario 4

You would like some fashion advice on which garments would look good on your body type. You have the option of using your body scan data with a **PERSONAL SHOPPER** service that offers advice on your clothing choices, advises you on styles that look good on your body, and also keeps a record of your previous purchases. How interested are you in this service?

Don't Know	Not At All		Neutral		Very Interested
0	Interested	2	3	4	5
	1				

Scenario 5

You are shopping online and find a website that offers a **CO-DESIGN** service that allows you to be involved in the process of designing your own unique garments. This process allows you to use your body scan to see how a set of options such as style, fit, color and fabric features would look on your body. You can then choose the features that look best to develop your unique garment. How interested are you in this service?

Don't Know	Not At All		Neutral		Very Interested
0	Interested	2	3	4	5
	1				

Scenario 6

You have the capability of using your body scan data, which includes your body measurements, to develop patterns and/or dress forms. This **PATTERN-DEVELOPMENT** process would allow you to sew your own clothing using patterns custom designed for your body. How interested are you in this service?

Don't Know	Not At All		Neutral		Very Interested
0	Interested	2	3	4	5
	1				

Scenario 7

You have the option of having your body scan data used by apparel companies in their **RESEARCH** to perfect their sizing systems and ultimately, improve the fit of their garments. This would allow your body type and measurements to be represented within the company's sizing system. How interested are you in this service?

Don't Know	Not At All		Neutral		Very Interested
0	Interested	2	3	4	5
	1				

The second data set was a small convenience sample of 34 undergraduate female apparel students used only to provide a comparison sample based on age. Data from the two samples were compared to test whether age affected participant interest and use of technology, and particularly, interest in specific body scan applications. The students participated voluntarily and were given extra credit points for participation.

These student participants varied in age from 19-22 years. They were scanned only once in either their street clothing or in the Lycra scan suit. Following the scan session, each participant completed a questionnaire with the same subset of questions on interest in commercial applications of body scan data as the first sample and were offered a disk with a movie file of their scan to take home.

Description of the Two Samples

By design, participants in the first sample reflected a target market of women who were of an age to be established in a career and family that brought knowledge of what type of clothing and fit that they wanted (see Table 2). The women ranged in age from 34 to 55 years with a mean of 44.9 years. The age distribution was balanced with 20% in their 30's, 57% in their 40's, and 23% in their 50's. The education and household incomes of the sample were relatively high: mostly college educated (66%), 40% of those with graduate degrees, and a majority with annual household

incomes over \$50,000 (56%). Eighty-two percent were employed full time, with 42% in professional positions, 23% in middle management, and 14% as administrative assistants. Only seven subjects were homemakers and only three were students. More than half of the sample was married (60%). Fifty-two percent of the sample had either one (22%) or two (30%) persons in their households and the sample mean was 2.7 household members.

In contrast and to consider the influence of age, the comparison sample was 34 female students between the ages of 19 and 22 years who had completed one to three years of college.

Table 2
Description of the Two Samples

	Sample One 34-55 years of age (N = 203)	Comparison Sample 19-22 years of age (N = 34)
Average age	44.9 years	20.44 years
Education	66% Bachelor's degree or higher	-
Household income	\$50,000 or higher	-
Ethnicity	84% Caucasian	82% Caucasian
Marital status	60% Married	-
Ave. # in household	2.70	-
Full-time workers	82%	-
Occupation		Student
Professional	42%	-
Middle Management	23%	-
Adm. Assistant	14%	-
Other	21%	-

Results

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Sample One and Comparison Sample

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Interest in Body Scan Data Applications

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Participants from both samples were overwhelmingly positive about the body scan process and the potential for commercial applications using body scan data. Eighty-eight percent of Sample One participants (77% of the comparison sample) were comfortable or very comfortable with the scanning process, 98% (97%) were willing to be scanned again, 43% (24%) were willing to be scanned once a year and 28% (39%) every six months. There were no

significant differences between the two samples on these variables. Additional results about consumer comfort with body scanning are reported in a companion paper (Loker et al., 2004).

Figure 1 and Tables 3 and 4 present the participant reactions to potential commercial body scan applications based on the scenarios about the seven commercial applications: automated custom fit, fit prediction, virtual try-on, personal shopper services, co-design mass customization,

custom pattern development for home sewers, and research. When rated individually on a five-point scale where 1 is not at all interested, 3 is neutral and 5 is very interested, Figure 1 shows that Sample One participants (and the comparison sample) indicated a high level of interest: 94% (88%) were interested in or very interested in virtual try-on, 94% (94%) were interested or very interested in size prediction, 82%

(82%) in custom fit, 83% (56%) in personal shopper, 73% (86%) in co-design, 47% (63%) in custom pattern development, and 88% (61%) in research. When asked which application was most appealing, virtual try-on was chosen by 35% (34%) of the sample, far ahead of custom fit clothing 16% (17%), size prediction 16% (17%), and personal shopper 15% (17%) in popularity.

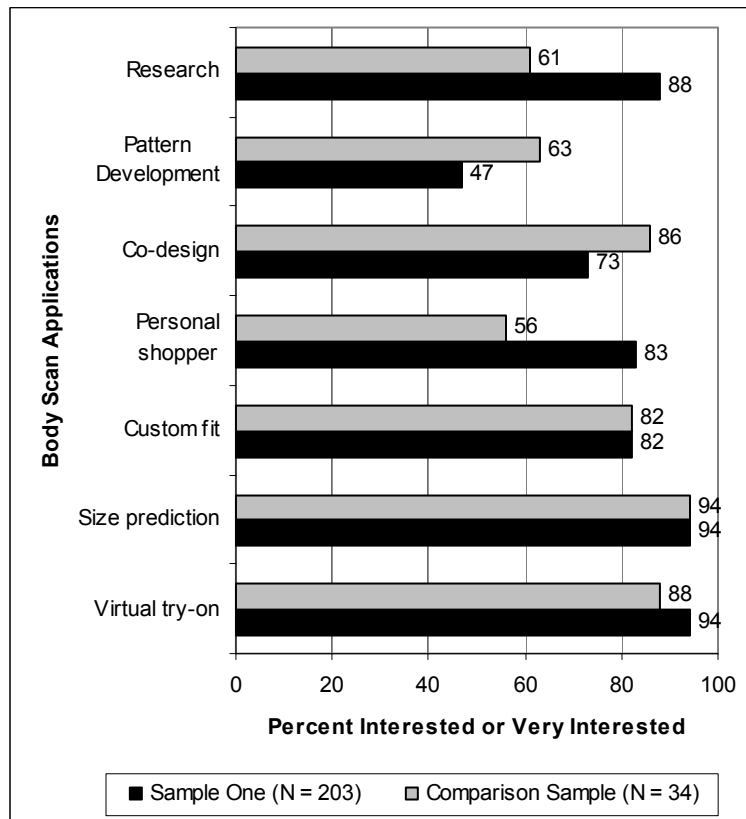


Figure 1. Percent Interest in Body Scan Applications by Sample

Table 3 presents means and *t* test results comparing Sample One responses with the younger comparison sample. While the older respondents in Sample One rated interest in size prediction (4.7), virtual try-on (4.6), personal shopper (4.5), and research (4.5) highest in that order, the

younger respondents in the comparison sample were most interested in size prediction (4.6), custom fit (4.4), virtual try-on (4.3), and co-design (4.3). The Sample One participants were significantly more interested in personal shopper services and research than the comparison sample.

Table 3

Comparison of Consumer Interest in Commercial Applications of Body Scan Data by Sample

	Mean Interest		T-Test	Most Appealing (%)	
	Sample	Comparison		Sample	Comparison
	One (n = 199)	Sample (n = 34)		One (n = 200)	Sample (n = 34)
Virtual try-on	4.6	4.3	-1.63	35.0	32.4
Custom fit	4.3	4.4	0.44	16.0	17.6
Size prediction	4.7	4.6	-0.40	15.5	17.6
Personal shopper	4.5	3.4	-3.68*	14.5	2.9
Co-design	4.1	4.2	0.63	8.0	17.6
Pattern Development	3.1	3.6	1.52	5.5	11.8
Research	4.5	3.5	-5.71*	4.5	0.0
Missing Response				1.0	-
				100	99.9

Note. Includes interest responses on a 5 point scale where 1=not at all interested 3=neutral 5=very interested

* $p \leq .01$

Table 4 presents the commercial applications rated most likely to influence the participants to buy more clothing on the Internet, to find clothing that looks good on the body, to find clothing that fits, and to find clothing on the Internet that fits. Virtual try-on applications were selected as most likely to influence participants to buy more clothing on the Internet (46.8% of Sample One; 38.2% of the comparison sample) and that help find clothing that looks good on the body (27.9%; 41.2%). Sample One chose virtual try-on (27.9%), personal shopper

(25.4%) and custom fit (23.9%) as good ways to find clothing that looks good, while the comparison sample only identified virtual try-on (41.2%) and custom fit (32.4%) as useful for this category. Custom fit (45.5%; 50.0%) and size prediction (24.8%; 23.5%) were the applications rated highest in helping to find clothing that fits in both samples. Custom fit (40.6%; 32.4%), virtual try-on (26.5%; 26.2%), and size prediction (20.3%; 26.5%), in that order, were rated most likely to help find clothing that fits on the Internet by the two samples.

Table 4

Consumer Evaluation of Commercial Applications of Body Scan Data for Sample One (N = 203) and Comparison Sample (N = 34)

	Influence to buy more clothing on the Internet (%)		Help find clothing that looks good on the body (%)		Help find clothing that fits on the body (%)		Help find clothing on the Internet that fits (%)	
	Sample	Comparison	Sample	Comparison	Sample	Comparison	Sample	Comparison
	One (n = 201)	Sample (n = 34)	One (n = 201)	Sample (n = 34)	One (n = 202)	Sample (n = 34)	One (n = 202)	Sample (n = 34)
Virtual try-on	46.8	38.2	27.9	41.2	13.9	20.6	26.2	26.5
Custom fit	15.9	20.6	23.9	32.4	45.5	50.0	40.6	32.4
Size prediction	14.4	11.8	8.5	11.8	24.8	23.5	20.3	26.5
Personal shopper	11.9	11.8	25.4	8.8	6.9	0.0	2.5	2.9
Co-design	4.5	11.8	10.9	0.0	5.0	0.0	5.9	0.0
Pattern development	1.0	0.0	2.0	5.9	2.5	5.9	2.0	2.9
Research	1.5	0.0	1.0	0.0	1.0	0.0	1.5	2.9
None	4.0	5.9	0.5	0.0	0.5	0.0	1.0	5.9

Sample One

Further analyses were conducted on Sample One participant data to characterize the consumers who are most interested in and likely to use body scan applications if commercially available. Participants were divided into groups based on their satisfaction with the fit of ready-to-wear pants, their level of shopping for clothing on the Internet, their sewing behavior, and whether they wore a Misses or Women's pant size.

Interest Based on Satisfaction with Fit of Ready-to-Wear

Sample One participants were divided into three groups by their level of satisfaction with ready-to-wear (RTW) pants fit—satisfied, neutral, and dissatisfied. Then, ANOVA comparisons were run for questions involving interest in specific applications of body scan data and

likelihood that specific applications would help in selection, fit, and purchase of clothing (see Table 5). Although all groups had means above 4.27, participants satisfied with RTW pant fit rated their interest in Virtual Try On applications ($F = 5.98, p \leq .003$) significantly lower than dissatisfied participants. No significant differences were found between neutral and dissatisfied participants. Participants satisfied with RTW pant fit rated their interest in custom fit applications ($F = 5.54, p \leq .01$) significantly lower than those participants who were neutral or dissatisfied with RTW pant fit. In this case, the ratings ranged from 3.91 to 4.46 on a 5-point scale. Satisfied participants rated their likelihood to look for clothing on the Internet ($F = 3.83, p \leq .02$) significantly lower than neutral and dissatisfied participants if online services using body scan data were available. Interestingly, the participants neutral in satisfaction of RTW pants were significantly more likely to buy clothing on the Internet ($F = 3.43, p \leq .03$) than the satisfied or dissatisfied participants.

Table 5
Interest in Commercial Applications of Body Scan Data and by Satisfaction with Ready-to-Wear Pant Fit for Sample One (N = 203)

	RTW			F
	Satisfied (n = 44)	Neutral (n = 50)	Dissatisfied (n = 105)	
Virtual try-on	4.27 ^a	4.54 ^{ab}	4.73 ^b	5.98**
Custom fit	3.91 ^a	4.38 ^b	4.46 ^b	5.54**
Likelihood to look for clothing that fits on the Internet	4.07 ^a	4.50 ^b	4.52 ^b	3.83*
Likelihood to buy more clothing on the Internet	3.76 ^a	4.32 ^b	4.20 ^a	3.43*

Note 1. Includes satisfaction responses on a 5 point scale where 1=extremely dissatisfied 3=neutral 5=extremely satisfied

Note 2. Superscripts unique to one mean indicate a significant difference between that mean and all others at p .05. A set of superscripts indicates that the mean is not significantly different from those means with any of the common superscripts.

Note 3. For the likelihood variables, the question states: *If the online services of Virtual Try-on, Size Prediction, Custom Fit, Personal Shopper, Co-design, and Pattern Development were readily available, how likely would you be to:*

Look for clothing on the Internet? Buy clothing on the Internet?

**p ≤ .01 *p ≤ .05

Sample One participants were divided into two groups based on whether they shopped for clothing on the Internet ($n = 117$) or not ($n = 85$). Internet shoppers were significantly more interested in the size prediction application ($M = 4.77$ and 4.52 ; $t = 2.47$, $p \leq .01$) and significantly more likely to look for ($M = 4.66$ and 4.06 ; $t = 4.58$, $p \leq .00$) and buy ($M = 4.49$ and 3.64 ; $t = 5.74$, $p \leq .00$) clothing on the Internet if the body scan applications were available.

Sewers and Non Sewers

Sample One participants who were likely to sew their own clothing ($n = 57$) were significantly more interested in the co-design ($M = 4.38$ and 3.94 ; $t = -2.36$, $p \leq .02$) and pattern development ($M = 4.72$ and 2.28 ; $t = -17.29$, $p \leq .00$) applications than those unlikely to sew. Sewers were also significantly more likely to buy ($M = 4.02$ and 4.41 ; $t = -2.12$, $p \leq .04$) clothing on the Internet if these body scan applications were available. Both groups rated virtual try-on as most appealing but more non-sewers (39.4%) than sewers (26.3%) indicated this preference. Sewers (15.8%) were more likely than non-sewers (.8%) to choose pattern development application as the most appealing application. Non-sewers were more likely to choose size prediction (15.7%) than sewers (5.4%).

Misses or Women's Pant Sizes

Although Sample One participants who wore Women's pant sizes ($n = 48$) rated co-design ($t = -2.00$, $p \leq .00$) and pattern development ($t = -3.80$, $p \leq .00$) applications significantly more interesting than participants who wore Misses' pant sizes ($n = 155$), the mean ratings for interest in co-design ($M = 4.01$ for Misses and 4.48 for Women's) were overall much higher than the mean ratings for interest in pattern development ($M = 2.94$ for Misses and 3.79 for Women's). There were no other significant differences related to applications of body scan data between women who wore different pant size categories.

Discussion and Implications

The overall interest in commercial applications of body scan data was positive in both samples of women, 34-55 years and 19-22 years of age. Their ratings of the usefulness of the six commercial applications and research with body scan data were also high, but varied by objective. For example, virtual try-on was rated highest as an influence to buy more clothing on the Internet, to find clothing that looked good on their body, and second to the custom clothing application to help find clothing that fit on the Internet. Custom clothing applications were rated highest for finding clothing that fit and size prediction was second. These results suggest great potential for body scan applications based on consumer interest and indicate some specific marketing strategies to address the needs of specific target markets. Given the large number of women who report dissatisfaction with fit in the population (often in the 50% range) this is a promising opportunity for apparel companies. Specifically, businesses with a competitive strategy that focuses on fit should consider virtual try-on as well as custom fit applications of body scan data. Internet only businesses should consider several of the commercial applications that increase the consumer's confidence in purchasing apparel and apparel that fits, such as virtual try-on, custom fit, and size prediction. Businesses targeting 34-55 year old women may want to consider adding a personal shopper service.

The evaluation of the usefulness of specific applications was highest for virtual try-on, custom fit, and size prediction in both samples with one exception. Personal shopper service was ranked highest by 25% of the female participants in Sample One, second to custom fit, to help find clothing that fits. This suggests that the 34-55 year old woman might be a special target group for personal shopper services. Personal shopper services on the Internet may need to pay special attention to developing a relationship between buyer and salesperson.

Co-design is a very new concept to U.S. consumers and one that might be uncomfortable to consumers due to its personal design responsibilities and its lack of testing and try-on opportunities before purchase. Our results suggest that custom pattern development would only be interesting to those who want to sew their own clothing and in our samples, even sewers, had low interest in this application. Research to help participants in finding and purchasing clothing that fits and looks received low ratings. These participants all volunteered to be scanned and many indicated during the process that they would “do anything to help in getting pants to fit better.” The low ratings for research in both age groups might indicate skepticism that anything they might contribute to the research process has a low probability of influencing the apparel industry to make effective changes.

The differences in the two samples in their interest in personal shoppers and co-design reflect a difference in the two populations with respect to comfort with the related activities of designing and choosing appropriate styles for themselves. The subjects in Sample One, representing an older demographic, would like help choosing clothing (personal shopper) and were less interested in having input in design (co-design) than the younger, student comparison sample. However, there might be different results from a more general sample of students. This comparison sample included only students in an apparel class and therefore those who were interested in and trained in style selection.

Consumers more interested in these applications of body scan data can be differentiated by their personal characteristics and shopping behaviors to some extent. Participants in this study who

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were Internet buyers who were dissatisfied or neutral with the fit of RTW pants were likely to sew their own clothing, and were more likely to look for and purchase clothing on the Internet if these applications were available. Therefore, these personal and shopping characteristics should be targeted by businesses offering or defining their niche with commercial applications of body scan data.

Consumer reactions to the various commercial applications of body scan data require more study. Interest in virtual try-on, size prediction, personal shopper services, and custom fit all received very high mean scores for both age groups, 34-55 years and 19-23 years. However, the appropriate level of consumer involvement and how to help consumers make the shift to this involvement are still unknown. Research using an experimental design that compares several approaches such as in-store kiosks, informal classes, on-line tutorials, and electronically accessed personal shopper services would be one approach. Another would be focus group testing with research Internet sites where participants could talk about their virtual shopping experiences enabled by body scan data and its innovative commercial applications.

The frontiers of commercial applications of body scan data are currently being defined. The process is exciting for researchers, new business start-ups, established businesses, service providers, and the consumers who will use commercial applications to purchase clothing. The one sure thing is that commercial applications of body scan data will take a variety of forms and consumers will be able to choose which applications fit their functional needs, risk levels, and desire for experiential adventure. Consumers, in the end, will determine which applications will be commercially profitable.

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