



A Design Process for a Female Auto-Racing Suit

Fei Wang, Hang Cui, Tracie Tung, and Wei Cao, California State University Northridge, USA

Xu Wang, Henan University of Engineering, P. R. China

Key words: Female auto-racing, suits, functional, product development, motorsport

Introduction

Professional auto racing is one of the leading motorsports around the world and attracts both male and female fans and drivers. It is the number one spectator sport in the United States boasting 75 million fans, and these fans help bolster the local economies of the cities that host races (Odland, 2012). The industry has experienced substantial financial growth in recent years; this is directly linked to the increasing percentage of women participating in racing (Odland, 2012). Notably, car racing is the only sport in which men and women compete at the same time; gender difference is ignored. However, while more and more women racers participate in the sport, available female racing suits in the market are limited. Most racing suits claim to be unisex but are created based on men's body type.

Modern-day car racing remains a dangerous sport full of extreme injuries, collisions and fires. An adequate racing suit plays a vital role in any professional racing sport. Due to human physiology difference by gender, women have a higher risk of injury when compared to men (Cerrelli, 1994), especially neck strain injuries resulting from car accidents. (Welsh & James, 2001). In addition, the development of vehicle designs, crash testing programs, and racing regulations is based heavily on male body performance (Welsh & James, 2001). Female racers' clothing needs have been neglected in the fast-growing market and little scholarly research has been conducted in this field. Thus, the purpose of this study is to investigate female racing car drivers' special clothing needs and to propose several practical solutions to fulfill their expectations. More specifically, the objectives are: 1) to investigate the existing problems, such as mobility and comfort, while wearing unisex racing suits, 2) to identify female racers' clothing needs and develop a collection of female-specific racing suits with consideration of functional, expressive and aesthetic attributes to make improvements in their performance, and 3) to evaluate the newly designed female racing suit prototype through a wear test and the feedback from professionals, ensuring that female racers' expectations are met.

Theoretical Framework

The Functional, Expressive and Aesthetic Consumer Needs Model (FEA Model) by Lamb and Kallal (1992) and their design process were adopted to develop the female racers' suit in this study. The model and design process provided a guide to identifying the users' needs and design criteria through a systematic

Page 1 of 3

Published under a Creative Commons Attribution License (<https://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

ITAA Proceedings, #76 - <https://itaonline.org>

exploration. The *functional* component includes fit, mobility, comfort, thermal protection, and donning/doffing. The *expressive* component includes elements of values, roles, status, and self-esteem. The *aesthetic* component includes elements such as art elements, design principles, and body/garment relationship. The design process consists of six stages: 1) Problem Identification, 2) Preliminary Ideas, 3) Design Refinement, 4) Prototype Development, 5) Evaluation, and 6) Implementation. This study adopted the design process from the Problem Identification to the Evaluation stage.

Procedure and Method

This study employed both qualitative and quantitative approaches, including a face-to-face interview, an online questionnaire (with multiple-choice and open-ended questions), and a wear test. The interview was conducted on campus with two amateur female racing car drivers. The purpose of this interview was to understand the female race car drivers' problems with current suits, such as comfort and mobility issues indicated in the pilot study, their role conflict as a female and a racer, the impact of their body-garment relationship in fit and performance, and art/design elements for aesthetics and femininity. Based on the interview, an online survey was developed. The survey consists of four parts: 1) addressing female racers' experiences with their current race suiting in purchasing options, size, price, color, durability etc.; 2) female racers' satisfaction with their current racing suits; 3) an open-ended question asking for suggestions on how to improve the functional, expressive, or aesthetic aspects of the racing suit; 4) their demographic information. An existing email list of 74 professional car racing athletes obtained from the pilot study was used to recruit participants.

Results

Online Survey. Nine female car racing athletes responded to the online survey. The age ranged from 16 to 55 years. Most of them were white (88.9%). Their racing experience ranged from 4 to 25 years. Their body types are "full hourglass" (n=4), "neat hourglass" (n=4), and "apple" (n=1). Eight of them (89%) reported that they have fit problems with their current unisex racing suit, such as too big or square for the female figure. More than half of them agreed that fit problems could impact the protection function. For the walking position, three of the participants (33%) considered the waist area to be too big and chest area to be too tight. Two of them reported leg length was too long, and one thought the crotch should be designed to allow more room. For the driving position, three of them (33%) mentioned the chest area was tight which impacted their body movement while driving. Two of the participants were not satisfied with the hip size and leg length of the racing suit when sitting, they preferred the bigger hip size and shorter leg length. One of them complained about the tight crotch design when driving. Six (67%) reported they wanted to show their gender role and would feel more confident if they were wearing a female racing suit versus a unisex suit when competing. Seven participating female drivers (78%) desired to look more feminine and fashionable when wearing a racing suit.

Prototype Development. Based on the interview and online survey, the prototype design focused on the pattern modification related to the restriction of movements in armhole, crotch, thigh, waist, and chest while female racers were sitting and driving. The role identification and feminine characterization were considered in the prototype development through motifs and color combinations. Four designs were developed, and design number four was selected for the actual prototype development. The prototype was based on a size medium woman with a full hourglass figure (according to the wear test participant).

Evaluation. The prototype was evaluated by four professionals (apparel designers, manufacturers, and apparel industry experts) and by an amateur female racer (wear test). They reviewed the design process, checked the patterns, and assessed the racing suit. The conclusion was as follows: the new prototype improved the fit and mobility; adding the princess line helped balance the female racer's need for both functional and expressive; detailed feminine designs such as blue with floral stitching along the collar and armhole were inspirational; and the silhouette looked great with a belt. In terms of suggestions, their feedback included: developing patterns for different body types such as "Apple" and "Pear;" adding more feminine patterns in the front and back of the lower body, providing more options in color combinations, adding breathable design under the armhole and the back of the suit, and developing a functional bra attached to the suit.

Conclusion

This systematic study provides critical thinking regarding unisex racing suits and proposes important design ideas to help guide apparel designers and manufacturers to develop adequate and protective gear for female car racing athletes that meets their unique needs.

References

- Cerrelli, E. (1994). Female drivers in fatal crashes recent trends (Report No. DOT HS 808 106). Washington, DC: National Highway Traffic Safety Administration.
- Lamb, J. M., & Kallal, M. J. (1992). A Conceptual Framework for Apparel Design. *Clothing and Textiles Research Journal*, 10(2), 42–47. <https://doi.org/10.1177/0887302X9201000207>
- Odland, S. (2012, February 27). NASCAR is back. *Forbes*. Retrieved from <https://www.forbes.com/sites/steveodland/2012/02/27/nascars-back/#1099218236a1>
- Welsh, R., & Lenard, J. (2001). Male and female car drivers-Differences in collision and injury risks. *Annual Proceedings. Association for the Advancement of Automotive Medicine*, 45, 73-91.