

The Delicate Awe: Inclusive Eveningwear

Li Jiang, Iowa State University, USA

Faculty Mentor: Rachel J. Eike, Ph.D., Iowa State University, USA

Keywords: Adaptive clothing, functional design, harnessing system, eveningwear

Contextual Review and Concept. In recent years, adaptive clothing and functional wearable products are being embraced by the fashion industry and academia to provide more apparel items for specialized markets. However, some specific designs have not been updated for many decades. For example, the ‘Figure of 9’ harness system used to accompany prosthetic devices to actuate and control the prosthetic grip has remained stagnant since 1955 (Pursley). The ‘Figure of 9’ harness system is typically worn and used by unilateral amputee individuals to activate their body-powered prosthesis device (see figure 1). The main feature of a body-powered prosthesis is to provide force and displacement feedback to the wearer, who will estimate the magnitude of the forces exerted to open/close the terminal device for grasping or gripping capabilities (Gudfinnsdottir, 2013).

Body-powered prostheses users have expressed a high rejection rate of the ‘figure of 9’ harness connected to discomfort (such as excessive pressure in the shoulder and axillary areas), skin irritations, restricted movements, and/or the need to wear additional clothing layers or additional

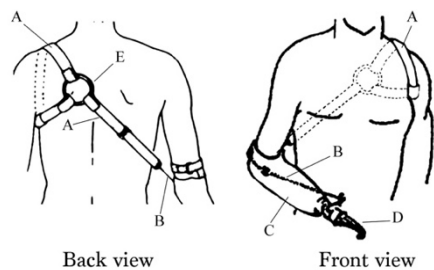


Figure 1. Schematic figure of a conventional body-powered prosthesis. (A) shows harnessing system, (B) the Bowden cable, (C) the socket, (D) the terminal device, and (E) metal ring to join webbings of the harnessing system

protective elements between skin and harness (Biddiss et al., 2007; Fryer, 1992). The harness design itself can be very restrictive for women with aesthetic needs and certain expressive requirements, especially for special events that require formalwear occasion attire. Therefore, the purpose of this creative scholarship was to create an adaptive design a) to provide a functional solution to wearing challenges; b) to create an adaptive dress design for special occasion events; c) to utilize harnessing system properties for integration into the dress design. Ultimately, *The Delicate Awe* was to be a beautiful dress that any consumer would want to purchase, but it would also function for adaptive, prosthesis users’ functional needs. This project also provided a hidden surprise for the prosthesis user and evoked a sense of awe.

Design Process. Adaptive clothing is “a special clothing design made for people with impairment, ..., allowing more independence in dressing and more self-sufficiency” (Azher et al., 2012, p.53). To provide easy donning and doffing features, *The Delicate Awe* was designed into two pieces: a harness system and an attachable strapless dress, which can be worn together as a special occasion dress. The detachable function of the harness and dress allows for great convenience for prosthetic wearers, so that they can more easily change clothes (addressing donning and doffing challenges) without taking off the harness. Additionally, to provide versatility for the prosthesis user, the

harness and skirt can be separated completely and the harness unit of the ensemble can be used in combination with other clothing items to provide a more stylized offering to the currently available ‘figure of 9’ harnessing system. In addition to functional considerations in this design solution, making the harness portion of the design completely unnoticeable to other individuals may assist with social stigmas of amputees and prosthesis users. Thus, the design, *The Delicate Awe*, has the potential to enhance the aesthetic and emotional value of prostheses users and encourage vitality, increase social and emotional activities, and improve positive self-image.

Techniques and Execution. In order to address the discomfort challenges through functional design, the current ‘figure of 9’ harness system was developed into a new harness system with four straps and a wide belt. In order to anchor the harness to the body and disperse pressure, straps wrapped along the front and back sides of the body along the shoulder girdle and connected to a wide belt along the natural waistline. Center-front opening of the waist belt was designed for easy closure. This new harness system functions as the shoulder straps of the evening dress. Then, once the harness and waist belt are secured into place on the body, the strapless dress portion of the design can be easily attached via one-handed plastic clasps (commonly used in nursing bras).

A removable harness casing with ruffles was developed to improve aesthetic and expressive needs in a new harness system. The casing was made of cotton/polyester knit jersey fabric with a wrap closure to connect with the metal ring at the wearer’s back. The soft-touch knit jersey fabric provides a more comfortable option for skin contact compared to the nylon webbing in present ‘figure of 9’ harnesses. In addition, the jersey fabric provides some sweat absorption, which improves thermal comfort of the design for the wearer. Furthermore, stretchy lace ruffles were stitched on top of the harness casing to align with current trends ((Binkley, 2022) and the dress aesthetic. When detached from the strapless dress portion, the ruffle casings provide an aesthetically stylized harness option, should the user prefer. The removable harness casing also allows for the harnessing system to be easily laundered. The structure of the waist belt is similar to a corset, which has boning on the interior side. Three straps with adjusters were used as a closure on the front of this corset-like wide belt to enable unilateral amputees to don and doff independently. Therefore, the wearer can easily use one hand to pull the end of the straps to make the belt fit tightly their body or loosen to expand. To ensure strap excess would not lead to discomfort or extra bulk along midline of body, a piece of hook-and-loop tape was attached to the bodice to secure strap ‘tail’ into place.

After completing the design of the harness and casing, an attachable dress was created by draping on a size eight female dress form. The structure of the dress is comprised of nine pattern pieces (four pieces in the front and five pieces in the back) with invisible zipper along the side seam. The lack of feminine features is the biggest disadvantage of the traditional harness system for female wearers. Therefore, a cowl was draped for the neckline, and all panels were draped in bias to create a sleek, flattering, and body-skimming look. The bias-cut technique accentuates the woman's figure while allowing for comfortable movement. After samples of the design were created to

ensure function and aesthetic expectations were met, the final fabrics of printed silk georgette fabric, silk jacquard, and lace were selected to highlight the beauty, softness, and elegance of a woman and this design. Please review the following link for more images and details related to design features: <https://youtu.be/HKMsAO7Sut0>

Design Contribution and Innovation. This design successfully demonstrated a creative, yet functionally-focused design solution to comfort challenges experienced from the stagnant ‘figure of 9’ harness system design. *The Delicate Awe* yielded an elegant fashion gown that also addresses the expressive needs (confident self-image) and aesthetics needs (color, silhouette, and fabric) of the female body-powered prosthesis and harness wearers. Future design scholars may continue to propose innovative solutions that combine functional features and aesthetically pleasing design applications that all consumers would be interested in wearing.

References

- Azher, N., Saeed, M., & Kalsoom, S. (2012). Adaptive clothing for females with arthritis impairment. *Journal of University Medical & Dental College*, 3(2), 52-59. Retrieved from <http://jumdc.com/index.php/jumdc/article/view/360>
- Biddiss, E., Beaton, D., & Chau, T. (2007). Consumer design priorities for upper limb prosthetics. *Disability and Rehabilitation: Assistive Technology*, 2(6), 346–357. <https://doi.org/10.1080/17483100701714733>
- Binkley, C. (2022, April 8). *Volume is in for Spring 2022: "the more dramatic the better"*. Town & Country. Retrieved May 31, 2022, from <https://www.townandcountrymag.com/style/a39642565/volume-fashion-trend-spring-2022/>
- Fryer, C. M. (1992). Upper limb prosthetics. In K. H. Bowker, W. J. Michael (Ed.), *Atlas of limb prosthetics surgical, prosthetic, and rehabilitation principles* (pp. 107–131). essay, Mosby Year Book.
- Gudfinnsdottir, T. (2013). Design and evaluation of a new harnessing system for body-powered prostheses [Unpublished master’s thesis]. Delft University of Technology.
- Pursley, R. J. (1955). Harness patterns for upper-extremity prostheses. *Artificial Limbs*, 2(3).

