Preliminary analysis of social perception of upper limb prosthetic users

Carlos Gonell-Cruz[1], **Alba Roda-Sales**[1], Immaculada Llop-Harillo[1], Vicente Bayarri-Porcar[1], Margarita Vergara[1]
[1]Department of Mechanical Engineering and Construction, Universitat Jaume I, Castelló de la Plana, Spain
Email: rodaa@uji.es

Summary

Social perception of prosthetic users represents a complex topic influenced by factors such as prosthesis type, user demographics and observer biases. This study aimed to explore these factors through a survey-based visual analysis. Fifty-five participants were shown images depicting a woman, a man, and a child, both with and without upper limb amputation and using various types of arm prostheses. Participants rated each user based on perceived "warmth" and "competence", being concepts considered as universal dimensions of social cognition. Differences in evaluations were identified depending on the user and prosthesis type, emphasizing the need for further investigation into additional demographic factors to uncover their implications.

Introduction

The development of upper limb prosthetics has grown significantly, but social perception of prosthetic users remains complex, shaped by factors such as prosthesis type, user demographics, and observer biases [1,2]. Prosthesis type plays a critical role, as advancements in technology have produced more functional and lifelike devices, often viewed more favorably due to their natural appearance and enhanced utility [3]. User demographics also influence perception, as gender biases can shape views on men's and women's roles and capabilities [4]. This study seeks to explore these factors through a survey-based visual analysis**.**

Methods

Fifty-five participants (25 men, 30 women) (age 34.91±15.12) responded an online questionnaire. Firstly, they were provided with an overview of the most common types of arm prostheses, including passive cosmetics and active (mechanical, electrical, or myoelectrical) grip prehensor and anthropomorphic. Then, participants were shown rendered images depicting a woman, a man and a child with no amputations and also the same users with upper limb amputation without prosthetics (showing the stump), with a cosmetic prosthesis, a mechanical prosthesis with a grip prehensor, and a myoelectric anthropomorphic prosthesis. They were asked to rate each user in a 1-5 Likert scale (taking as a reference the user without amputation with a score of 5) regarding the perceived "warmth" and "competence", being concepts proposed in literature as universal dimensions of social cognition [4].

Results and Discussion

Figure 1 shows 95% confidence intervals for means plots of rates, separating results by assessed user and prosthesis type. Cosmetic and the anthropomorphic prosthesis are the best rated in warmth, while the prehensor one is the worst.

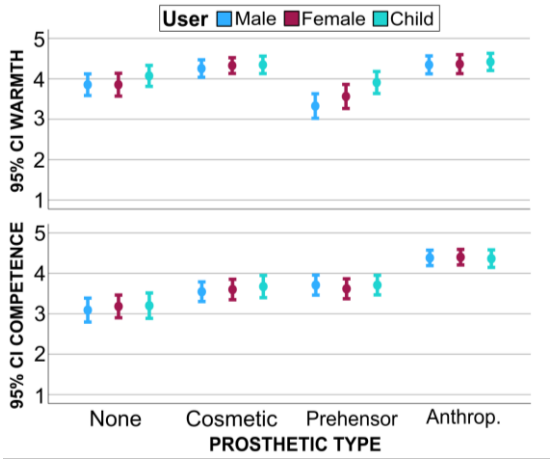

Figure 1: Rates obtained for "competence" and "warmth".

Interestingly, regarding users, the better rated in warmth was the child, followed by the woman user, implying a social biased perception. The anthropomorphic prosthesis was also the best rated in competence, being the users without prosthetics the worst rated. In terms of competence no differences were identified among assessed users. It is noteworthy that the anthropomorphic prosthesis achieved remarkably high ratings in both aspects, likely due to their human-like appearance (associated with warmth) and their perceived superior functionality (linked to competence). It is also remarkably that, even with previous knowledge that cosmetic prosthesis are passive, they are equally rated than prehensor ones, aligning with the basis of emotional design [5].

Conclusions

Differences were identified in the evaluations of the different prosthetic types and users, highlighting the importance of exploring additional demographic factors of assessing users. Future work should focus on analyzing significant differences more comprehensively, as this analysis served as a prospective exploration of the data.

Acknowledgments

Projects UJI-A2022-19 and UJI-2024-05 (Universitat Jaume I) and project CIGE/2023/89 (Generalitat Valenciana).

References

[1] Espinosa et al. (2019). *Proc. of the Human Factors and Ergonomics Society Annual Meeting*, **63**(1):1644-1648.
[2] Gallagher et al. (2001) *J Health Psychol*, **6**(1):85-100.
[3] Resnik et al. (2012) *Arch Phys Med Rehabil*,**93**(4):710-7.
[4] Friske et al. (2007). *Trends Cogn* Sci, **11**(2):77-83.
[5] Norman et al. (2004). *Emotional design: why we love (or hate) everyday things;* Basic Books.