Using the Contravision Approach to Elicit User Reactions to Future Manufacturing Technologies

Adrian Marinescu[1], Elizabeth M. Argyle[1], Joshua Duvnjak[1], Max Wilson[1], Sarah Sharples[1], Glyn Lawson[1], Ella-Mae Hubbard[2] and Laura Justham[2]

[1] University of Nottingham
[2] Loughborough University

Abstract

The future's industrial workforce will be a product of today's society. As manufacturing evolves to incorporate digital manufacturing technologies (DMTs), addressing societal concerns surrounding these technologies will support ethical and effective implementation.

Using the ContraVision technique (Mancini, et al. 2010), we developed two videos showing fictional, futuristic utopian and dystopian perspectives on DMTs. These videos were used to elicit feedback from the public on perceptions of these technologies. Results showed that regardless of the utopic or dystopic condition, participants acknowledged benefits of such technologies despite expressing concerns, specifically identifying issues around ethical implementation and data security.

Introduction

A major challenge to assessing perceptions of in-development or futuristic digital manufacturing technologies (DMTs) is that users have few ways to experience them fully. However, understanding perceptions early in the design process can help facilitate effective, ethical, and sustainable integration of technology into workplaces.

Contravision is a technique in which contrasting viewpoints to a scenario are used to provoke discussion on a topic of interest, often presented via video, images, or stories (Mancini et al., 2010). We employed the Contravision technique to understanding attitudes towards DMTs, focusing on the following research questions:

1. What are people's attitudes towards digital manufacturing technologies?
2. How does the portrayal of technology influence people's attitudes?

Digital Manufacturing Scenarios

Two videos were developed, illustrating a utopian perspective on DMTs versus a contrasting dystopian perspective. Both scenarios were framed around an interview with an employee of a fictional manufacturer in a small town. In both videos, the small factory underwent technology changes involving increased integration of DMTs into routine work patterns. The worker from the Utopic universe holds a positive opinion about the changes, whereas in the alternative Dystopic universe, the worker is highly negative and describes a restrictive implementation of the new technologies.

Figure 1. The videos focused on scenarios involving robotics, augmented/virtual reality and digital twins, and wearable sensors

Figure 2. A fictionalised view of the manufacturing environments in the utopian video (left) and dystopian video (right)

Study Design

- Between subjects experimental design with two conditions (utopian or dystopian video)
- 134 participants (39% male, 61% female), 80% under 50 years old
- The data was collected between 13 November 2020 and 3 November 2020 using the Prolific online platform
- Participants viewed their assigned video and completed a questionnaire
- Questionnaire elicited feedback on attitudes towards the technology and manufacturing environment presented in the videos, as well as attitudes towards DMTs in general

Questionnaire Findings

- Participants in the utopic condition held more positive attitudes towards technology and the manufacturer than those in the dystopic condition, as shown via a series of Mann-Whitney U tests (Figure 3)
- No significant differences found between conditions regarding perceptions of the degree to which digital technology impacts the UK as a whole, local community, a participant's family or the participant themself
- Sentiment analysis was performed on the open-ended feedback using the VADER (Hutto et al., 2014) sentiment lexicon (Figure 4). Sentiment scores were higher for most in the utopic condition, there were many participants with high scores (positive sentiment) in the dystopic condition.
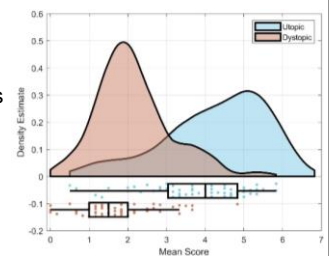

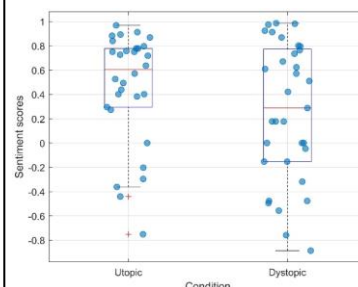Figure 3. Density estimate of mean scores for questions 1 to 6

Figure 4. VADER sentiment scores for the qualitative data

Perceptions & Challenges

- Thematic analysis identified areas of major concern and challenges for future DMT implementation
- Viewers of the dystopic video identified concerns for impact on wider society (including industry and perceptions of human value) and individual workspaces (isolation/less socialising and job security risks)
- Utopic video viewers voiced concern for ethical data capture and usage of personal data, potential for technology to be used to discriminate and degrade perceived human value, and held a range of individual positive and negative attitudes towards future DMTs

Acknowledgements

References

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