

# Enhancing Technologists' Ethical Awareness Through Critical Design

## Purpose of Research

My doctoral research investigates the potential for cross-disciplinary, sociotechnical pedagogical approaches to transform and reinforce the importance of ethics and responsible design in tech development. One way I do this is by designing, facilitating, and surveying the participants of various workshops, modules, and video tutorials related to ethics and responsible design in undergraduate engineering courses at the University of Waterloo. Critical Design, the main methodology of these curricular interventions, is an arts-based research practice that “challenges hegemonies and dominant ideologies in contexts of science and technology, social inequality, and unchallenged disciplinary norms” [1]. This ongoing research hopes to demonstrate how cross-disciplinary, sociotechnical pedagogical approaches can help prepare future technologists to critically analyze and mitigate the complex social, environmental, and economic challenges in the context of their work.

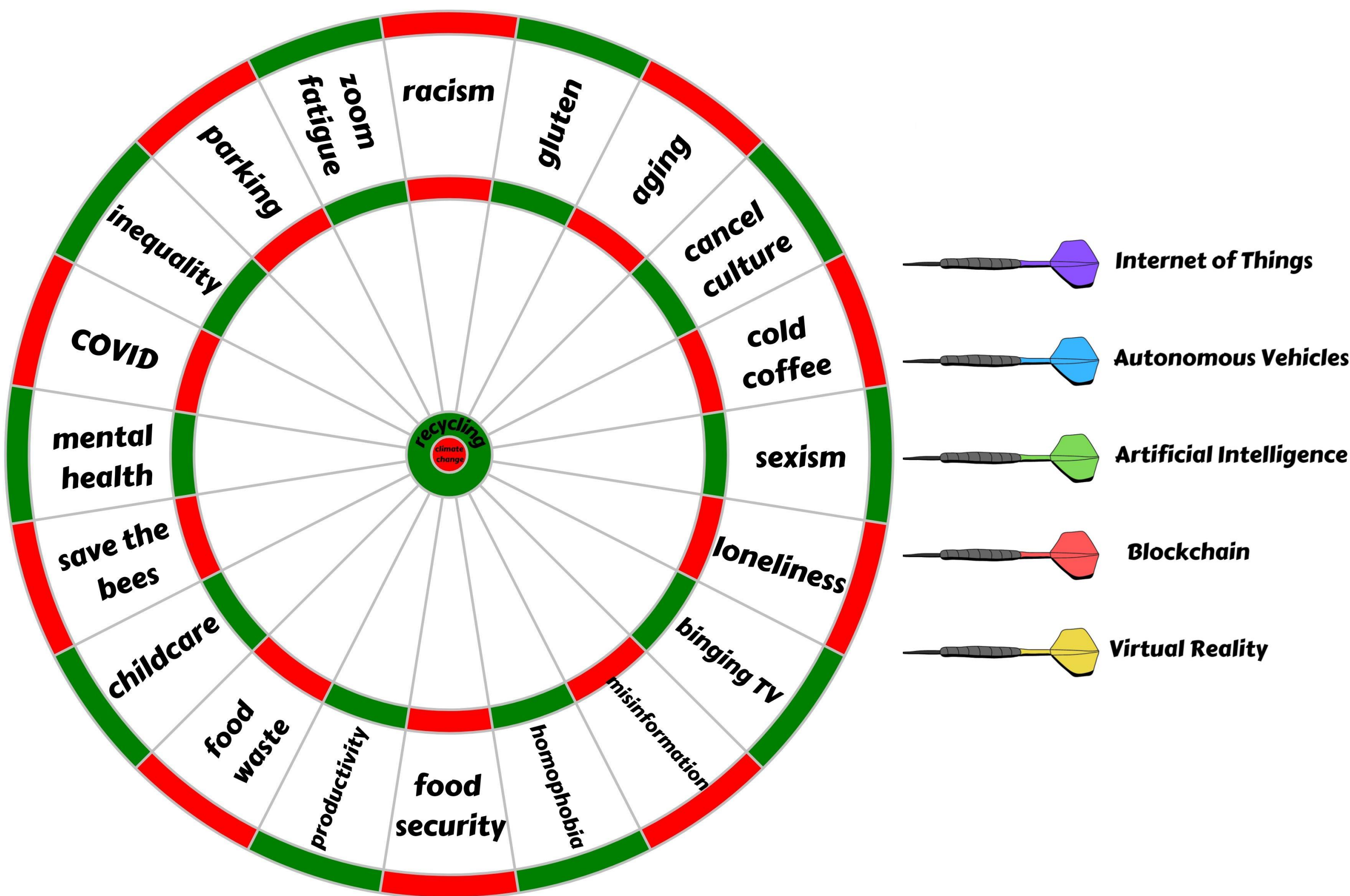


Figure 1: Copy of The Innovation Problem Finder Dartboard. Instructions: The user chooses the dart/technology they would like to apply in their project. Once landing on a section of the board, the user speculates as to how the technology could be used to improve, worsen, or recontextualize the topic on that section. This format allows for the topics/technologies to be adapted for different purposes. Designed by Alexi Orchard and Shannon Veitch, 2022



Figure 2: Two cards (of 12) from The Artefact Group's Tarot Cards of Tech <http://tarotcardsoftech.artefactgroup.com/>

## Pedagogical Methods for Ethics Education

Most ethics teaching in engineering disciplines utilizes professional codes of conduct (e.g., PEO Code of Ethics), case studies (e.g., The 1907 Quebec Bridge Collapse), and/or moral philosophy (consequentialism, deontology, etc.) [3]. However, these methods can be limited in helping technologists recognize and remedy ethical issues before, during, and after the design process. Sociotechnical frameworks, such as those recently introduced by Krakowski et al. [2] and Saltz et al. [4], prompt students to ask critical questions about topics such as data bias, fairness, and accountability alongside their learning of technical outcomes. We suggest that sociotechnical interventions integrated into the existing context of technical lessons are a viable route for embedding ethical thinking across the curriculum.

## Integrating Critical Design into the Technologist's Workflow

Critical design is a research practice that has been described as a mode of "problem finding" rather than "problem solving" [1]. More specifically, "critical design practice challenges hegemonies and dominant ideologies in contexts of science and technology, social inequality, and unchallenged disciplinary norms" [1]. Anthony Dunne and Fiona Raby [5], the design team that coined the term "critical design," note that it emerged from their "concerns with the uncritical drive behind technological progress, when technology is always assumed to be good and capable of solving any problem." Some modes of critical design include speculative fiction, 'what if?' statements, alternative histories, and objects-to-think-with. A popular example that uses speculative fiction is the TV show *Black Mirror*.

## Critical Design Tools

The *Innovation Problem Finder Dartboard* is a critical design object-to-think-with that helps users generate ideas about critical design while simultaneously critiquing an irresponsible technosolutionist approach to innovation (Fig. 1). The *Tarot Cards of Tech* by The Artefact Group are a deck of cards to help users consider opportunities and consequences that could arise from their design (Fig. 2).

## Assessing Students' Ethics Knowledge Survey Design

Following workshops, courses, and modules on ethics, critical design, and responsible innovation, this work utilizes mixed-methods qualitative and quantitative surveys that prompt students to demonstrate and reflect on the intervention and their knowledge of, experience with, and attitudes toward ethics in engineering practice. In the latest iteration (2022) of our post-intervention survey, we have implemented hypothetical scenarios to measure students' abilities to identify, mitigate, and reflect on ethical and equity-based issues in different contexts. For example:

*"In your capstone project, your group is collaborating with a local organization to develop a system for tracking the inventory in community fridges located in low socioeconomic neighborhoods."*

## Results

This research is ongoing. Since 2020, we have surveyed upwards of 300 students across the Faculty of Engineering who have participated in courses and interventions related to ethics, responsible innovation, and critical design. Preliminary results were published at the International Symposium of Technology and Society in 2021, titled "The Influence of Curriculum and Internship Culture on Developing Ethical Technologists: A Case Study of the University of Waterloo." (Scan QR) [6].



## Future Work

Next steps include revising current interventions, continuing to develop metrics for assessing students, and expanding participant groups to include more engineering programs and other disciplines at the university.

## References →

