Human Factors & Ethics Canvas

Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

PEOPLE
PROCESS
PERFORMANCE

Centre for Innovative Human Systems

Human Factors & Ethics Canvas

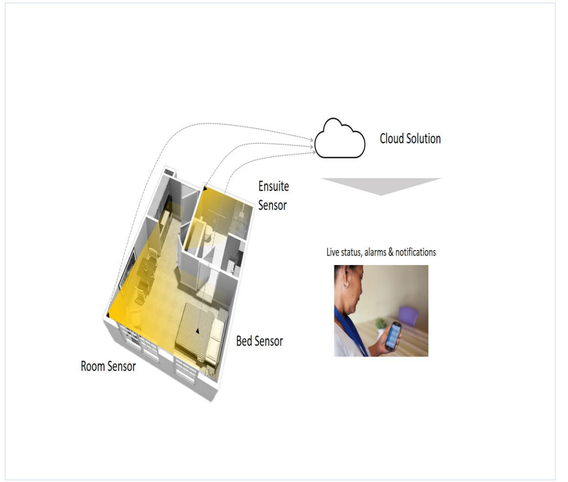
1. Background
2. Ontological Design
3. Progress & Human Benefit
4. Introduction to HFEC & Objectives
5. Stages
6. Using HFEC
7. Overview of each stage
8. Application & Examples
9. Conclusion
10. Publications

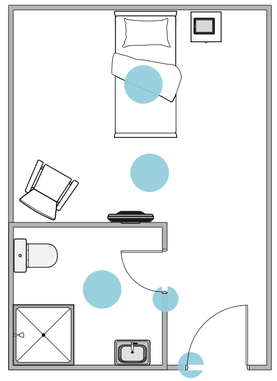
Background

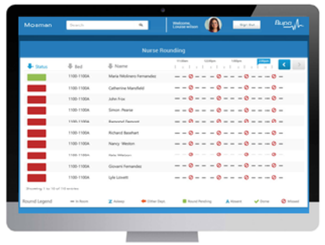
- **New technologies (including innovative AI & ML components) raise macro ethics questions concerning**
  (1) the intended use and purpose of technology
  (2) the role of the person
  (3) the impact of these technologies on our behaviour and activities (including potentially negative consequences)
  (4) societal values.
- **The beneficent uses of technology have a way of being co-opted for other purposes (Brobst, 2018)**
- Often there can be a **gap between the intended use** of a system and its use in terms of what is **implemented**
- The **psychosocial effects** of certain technologies are not always apparent

Background

- Improve the relationship between science and society
- **Human activity should not compromise the long-term balance between the economic, environmental and social pillars**
- Technologies can be narrowly conceived from an ethical standpoint.
- Technologies might be designed to be legal, profitable and safe in their usage.
- However, they may not positively contribute to human well-being and deliver benefits at different levels
- **Methodologies are required to enable the active translation of ethical issues pertaining to the human and social dimensions of new technologies, in a manner that considers the diversity of practices across research and innovation and commercial research projects**

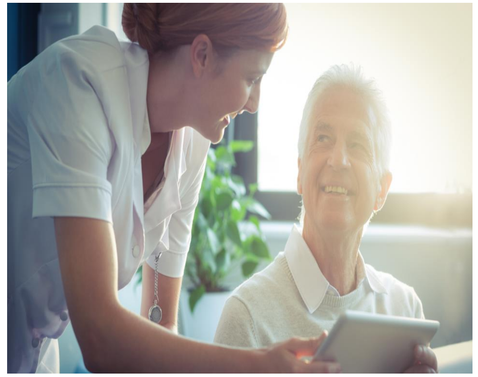






Background

- New technologies have the potential to deliver benefits - society, environment, economic (triple bottom line)
- Design/technology teams exercise choice in relation to what is valued and advancing technology that improves the human condition (and not worsens it).
- **Technologies are inherently uncertain.**
- Technology designers must examine the ethical implications of things which may not yet exist, or things which may have impacts we cannot predict (Capurro, 2009)
- **Human factors and ethical issues must be explored in an integrated way**



The primary problem for the ethics of emerging technology is the problem of uncertainty. That is, how to deal with the uncertainty of future products, uses and consequences, and associated ethical issues that will result from an emerging technology (Sollie, 2007).

Background

- **The responsibilities of designers and questions concerning the moral quality of technology belong to the field of Applied Ethics.**
- **However, they also belong to the field of Human Factors.**

Human Factors
Understanding who the **users** of the technology are **as people**:

- **Needs**
- Preferences, **values and acceptability**
- **Ability** (cognitive, motor, vision, hearing..)
- **Motivation**

Ethics
Moral principles that govern a person's **behaviour or how an activity** is conducted

Digital Ethics
Impact of digital Information and Communication Technologies (ICT) on our societies and the environment

Progress & Human Benefit

Advancement, Moving Forward, Improvement

TECHNOLOGY AVAILABILITY

LIVED EXPERIENCE & VALUES

Address non-trivial negative and unintended consequences of new technology

Ontological Design

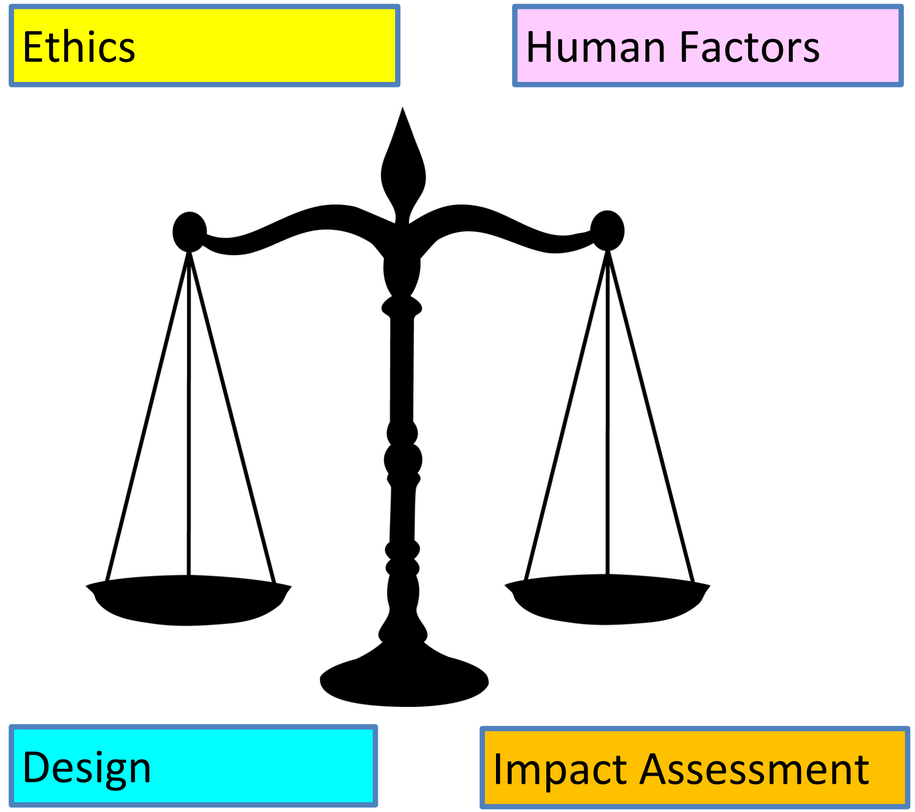
- Addresses how the design of technology changes our human and social reality (Heidegger, M: The Question Concerning Technology)
- “We are designed by our designing and by that which we have designed”(Fry, 2012)
- “We become what we behold”

Are we the designers or the designed?

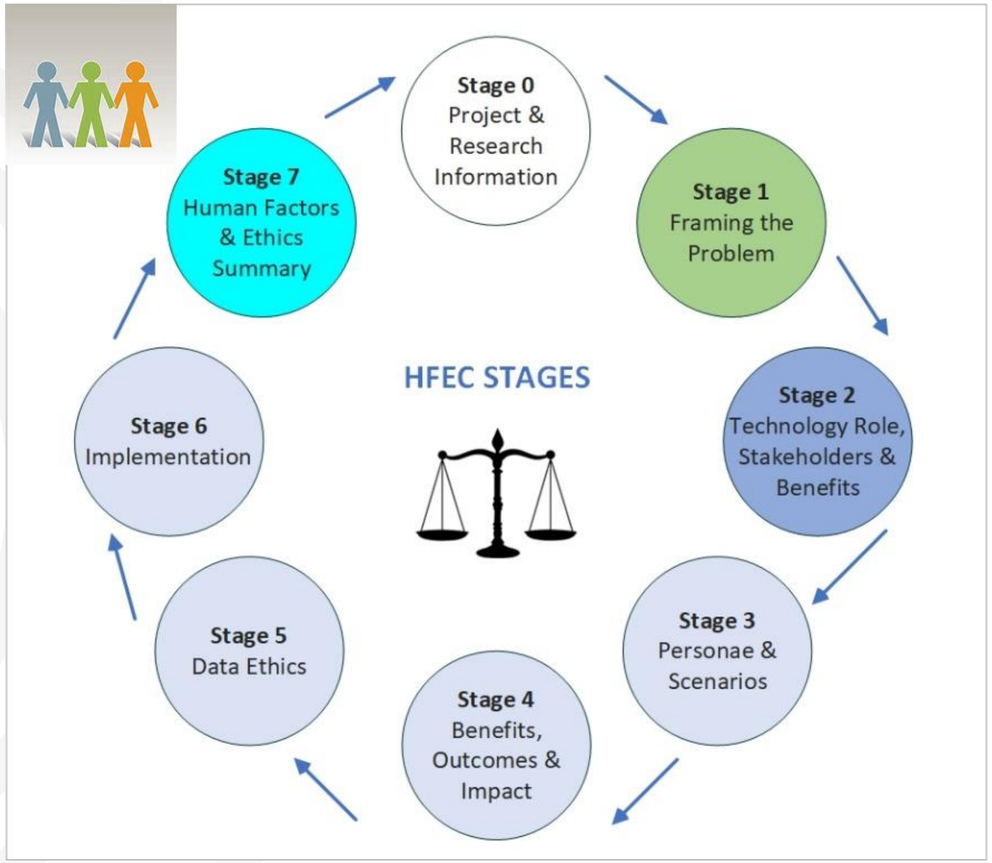
Martin Heidegger

Introduction to HFEC & Objectives

- **The objective of the 'human factors and ethics' canvas, is to create an evidence map in relation to the specification of an ethically responsible technology solution that properly addresses relevant human and ethical issues.**
- Directly address issues of ethics and social acceptability
- Integration of ethics and HF methods, particularly around the collection of evidence using stakeholder evaluation methods, personae-based design, scenario-based design approaches
- Makes use of ethical theories/perspectives that are used in relation to the analysis of technology innovation in relation to the analysis of benefit versus harm including Consequentialism, Deontology & Principlism



Stages


Stage 0
Project & Research Information
Stage 1
Framing the Problem
Stage 2
Technology Role, Stakeholders & Benefits
Stage 3
Personae & Scenarios
Stage 4
Benefits, Outcomes & Impact
Stage 5
Data Ethics
Stage 6
Implementation
Stage 7
Human Factors & Ethics Summary
HFEC STAGES

Using the HFEC

- **The HFEC can be used at any stage of the design process (iteration: requirements, design, and evaluation)**.
- Spans the classification of methods proposed by Reijers et al, 2017
- Overall, it combines **anticipatory/foresight approaches** and **participatory/deliberative ethics** approaches.
- In line with stakeholder evaluation approaches, the canvas can be evaluated using the '**community of practice**'
- That is, using internal stakeholders (project team) and external stakeholders (relevant ends users/stakeholders and legitimate other parties who may be impacted by the technology).

- At a minimum, **core internal stakeholders/core team members (including an ethicist {if available}, the HF lead, the design lead and the product owner/manager)** are involved in completing the canvas.
- If the project team includes an ethicist, then they should take the role of the **'HFEC' coordinator** - recording relevant information in the HFEC.
- Otherwise, this can be done by the HF lead or another designated member of the project team.

Using the HFEC

- An analysis of **literature review data and information from team problem solving sessions can be used to populate the HFEC**.
- However, it is best to **complete Section 3 & 4 either using stakeholder evaluation approaches** (either direct engagement of stakeholders in ethical assessment or following the analysis of field research with stakeholders).
- In addition, **Section 6 can only be completed following implementation and evaluation** of the proposed technologies.
- Ideally, this might occur in a field setting.
- However, **information from simulation studies** can also be used.

Using the HFEC: Key Points

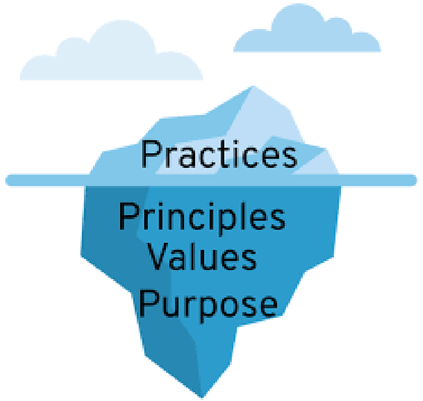
1. Define principles underpinning system
2. Define KPI
3. Define Impacts
   - Positive impacts
   - Negative impacts
   - Specific psychosocial impacts
   - Specific environmental impacts
   - Unintended consequences and unknown impacts

Design

- Embed ethical principles in system concept
- User functions & design features map to ethical principles
- Positive impacts must be supported by the system concept
- Potential negative impacts must be carefully managed in relation to the design concept and execution.

Using the HFEC: Key Points

- **Convergence between the analysis of new technology both from an ethics and human factors perspective** (for example, addressing stakeholder need, expected benefits and outcomes, and impact [intended and unintended] – both at an individual and societal level)
- **Ethical principles need to be both articulated and then embedded in the design concept**
- **Personae/scenarios** are useful in relation to considering and documenting the needs/perspectives of different stakeholders and adjudicating between **conflicting goals/principles**
- The translation of **system objectives in relation to wellbeing and human benefit objectives (and associated metrics)** ensures that wellbeing and human benefit are both a reference point and a design outcome.



Stage 0: Project Information & Summary

1	Date	
2	Project Name	
3	Product Owner	
4	HF & Ethics Coordinator	
5	HF & Ethics Canvas Version No.	
6	Research & Innovation Phase	
7	Summary of Research Completed & Key Sources of Information/Evidence	
8	Research Ethics Approval & Date	

Stage 1: Formulating the Problem & Posing the Question

1	What is the problem that the proposed technology will address?	
2	Who is it a problem for? Key stakeholders? Who effect (directly and indirectly?)	
3	Setting & Environment?	
4	Causes of the problem?	
5	Ethical codes that apply in this setting?	
6	Ethics embedded in the problem definition?	
7	Ethics & Impact of Problem. Individual Level. Societal level. Ethics of acting/not acting?	
8	Summary of ethical issues to be addressed.	
9	Summary of relevant ethics principles and frameworks.	
10	Ethics & Key KPI	

Stage 2: Understanding Technology & Fit to Problem/Stakeholder Needs & Expected Benefits

1	What is the technology? How does the proposed technology address the problem? What part of the problem does it address?	
2	What is the goal/objective? Intended purpose/function of technology?	
3	Setting & Environment?	
4	Direct users of technology? Goals? Needs? Expected Benefits?	
5	Other stakeholders impacted by technology? Goals? Needs? Expected Benefits?	
6	Design Decisions & Safeguards	

Stage 3: Stakeholders, Benefits, Consequences & Impact

<table>
<tr><td>1</td><td>Overall benefits and outcomes: key stakeholders?
Expected positive impacts?</td><td colspan="3"></td></tr>
<tr><td rowspan="4">2</td><td rowspan="4">Expected Impact for key stakeholders (psycho-social themes).
Individual level? Societal Level?</td><td>(A) Human role in the system</td><td>(B) Human Identity</td><td>(C) Lived experience, wellbeing, quality of life</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>(D) Social Interaction & Relationships</td><td>(E) Activity & Behavior</td><td>(F) Attitudes & Values</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>3</td><td>What could go wrong? Potential failures? Potential negative impacts? Psychosocial? Environmental?</td><td colspan="3"></td></tr>
<tr><td>4</td><td>Unintended consequences</td><td colspan="3"></td></tr>
<tr><td>5</td><td>Unknowns</td><td colspan="3"></td></tr>
</table>

1	Overall benefits and outcomes: key stakeholders? Expected positive impacts?			
2	Expected Impact for key stakeholders (psycho-social themes). Individual level? Societal Level?	(A) Human role in the system	(B) Human Identity	(C) Lived experience, wellbeing, quality of life
		(D) Social Interaction & Relationships	(E) Activity & Behavior	(F) Attitudes & Values
3	What could go wrong? Potential failures? Potential negative impacts? Psychosocial? Environmental?			
4	Unintended consequences.			
5	Unknowns			

Stage 4: Deep Dive (Personae & Scenarios)

1	Example Scenario	
2	Example Personae	
3	How is it expected to work?	
4	What does success look like? Benefits for whom? Expected positive outcomes and for whom?	
5	What could go wrong? Potential failures? Potential negative impacts?	
6	Unintended consequences?	
7	Unknowns?	
8	Design Decisions & Safeguards	

Stage 5: Deep Dive (Data Ethics)

1	Ethical issues relevant to data collection? What data? Why collecting? Potential for bias in data collection?	
2	Ethical issues relevant to data, model & algorithms? Potential for harm and risk?	
3	Ethical issues relevant to data use & predictions (i.e. application of model/algorithms)?	
4	Ethical issues relevant to data sharing?	
5	Design Decisions & Safeguards	

Stage 6: Deep Dive (Implementation)

1	Implementation Approach	
2	Implementation Enablers	
3	Implementation Barriers	
4	Systems Perspective: Addressing Ethics as part of Implementation. People. Process. Technology. Culture. Training & Education.	
5	Design Decisions & Safeguards	

Stage 7: Human Factors & Ethics Summary

1	Key stakeholders? Who is this technology designed for?	
2	What does success look like? Success for whom?	
3	Human/Societal Vision & Technology Role/Purpose.	
4	Summary of Key Ethical Issues to be Addressed?	
5	Ethical Principles Underlying Technology Design	
6	Design Approach: Balancing Benefits & Harm. How managing ethics issues? How increasing potential positive impacts? How preventing risk/harm? How managing potential negative impacts and unintended consequences? How addressing unknowns?	
7	Data Ethics Summary.	
8	Implementation Summary	
9	Ethics & Key KPI	

Application & Examples

1: Transport

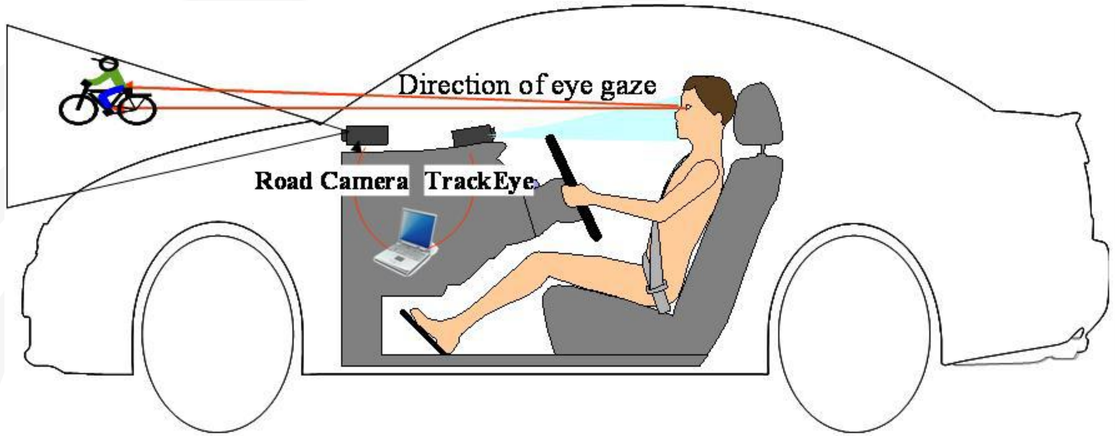
Adaptive Automation (Car for Older Adults)

2: Health Assisted Living (Wellbeing & Independence for Older Adults)

3: Health

Patient & Care Monitoring (Video & Vision Systems)

Assisted Driving (Framing the Problem & Solution)



- The design problem is to advance a system which can detect the health and psychological/emotional condition of the driver so that the vehicle responds as appropriate (i.e. promoting engagement/alertness, providing task supports, taking over the driving task if the driver is impaired and/or calling an ambulance).
- Critically, the co-pilot system will prolong safe driving for older adults with different ability levels, and in doing so help maintain cognitive and physical abilities.

- Design problem is framed in relation to a philosophy of ‘enablement’ and positive models of ageing.
- Vision of ‘technology progress’ in closely intertwined with concepts of progress from a societal values perspective
- The proposed co-pilot system is premised on concepts of successful/positive ageing and self-efficacy.
- System logic is underpinned by concepts of ability, adaption and assistance as opposed to vehicle automation
- Overall, the technology is designed to provide different levels of assistance/automation to drivers so that collisions are avoided
- We are proposing assistance (i.e. adaptive automation) and not full automation.
- Innovative multimodal methods – input and feedback

Assisted Driving (Underpinning Principles)

- The system should benefit all road users including older adults
- The system should support road safety (benefits all road users)
- The system should protect the rights of other road users and pedestrians who may be negatively impacted by older adult driving challenges and specifically, health events such as strokes and heart attacks.
- The system should enable continued and safe driving for all adults, including those adults at risk of limiting their driving and/or giving up
- The system should enable driver persistence – thereby supporting mobility and social participation for older adults
- The system should be premised on concepts of successful/positive ageing and self-efficacy (i.e. avoid ageist stereotypes)
- The system should promote driver engagement and provide alternatives to full automation

- The proposed technology should maintain the autonomy of older adults (i.e. the starting point is the engaged driver).
- The system should support all three pillars of older adult wellbeing (i.e. biological, psychological & social)
- The system should enable social inclusion and participation of older adults - this benefits society as a whole
- The system should protect human rights – including right to autonomy/choice, privacy (information access and protecting health and driver profile information)
- The system should be usable, accessible, and understood by people of all ages with different abilities and health conditions.
- Solution needs to comprehensively address real needs of people (diversity) and potential adoption barriers
- Human activity should not compromise the long-term balance between the economic, environmental, and social pillars (triple bottom line)
- The proposed mobility solution should consider environmental issues

Personae & Scenarios

James, 79 years

Retired Banker. Concerned about losing independence.

4. **Continuing drivers: older adults who have continued to drive with a progressing condition, but have concerns in relation to medical fitness to drive and are at risk of giving up**

P S E

" My driving is not as good as it used to be. I should talk to my Dr about these near misses and attention problems".

Ability & Health	Early cognitive decline (not formal Dementia diagnosis). Insomnia. Back pain. Bifocals.
Medications	Takes occasional painkillers for back pain and sleep medicines for Insomnia (hypnotics).
Driving Routines	Drives two to three times a week, often accompanied by wife. Recently, had one or two driving incidents (near miss), but not accident.
Behaviour	Meandering in lane, maintaining attention.
Pain-points & Challenges	Avoids high traffic density, night driving and motorways/high speed areas, difficulties maintaining attention.

Assisted Driving (KPI)

#	System Goal	Human Benefit & Wellbeing Objectives/Targets (Design Outcomes)	Metric (Outcome Indicators)
1	Safe driving for older adults	Driver feels safe Driver feels in control The car is in a safe state	Subjective perception of safety/security Objective measure of car safety (position on road/lane, speed)
2	Driver Persistence	Car as an enabler of active ageing/positive ageing – and allied health benefits Car contributing to eudaemonia (living well) Car contributing to a sense of having a purpose Car as an enabler of mobility Supporting social connection and participation Supporting citizenship etc	Health status Mobility status Positive human functioning and flourishing Social capitol Personal growth
3	Driver Experience	Driver feeling happy/enjoying driving activity Emotional state/psychological wellbeing (avoidance of stress) Driver in control Focus on ability (available capacity) Promote adaptation and bricolage	Subjective enjoyment of driving Subjective feeling of human agency/independence Subjective wellbeing

Publications, White Papers & Podcasts

- Cahill, J. McLoughlin, S., O Neil, N. & Wetheral, S. Ambient assisted living and ethical issues pertaining to patient and care monitoring. (In Press). Book Chapter for "Assisted Living: Current Issues and Challenges. Nova Sciences Publishers.
- Cahill, J., Cromie, S., Crowley, K, Kay, A., Gormley M, Kenny, E., Hermman, S, Doyle, C, Hever, A and Ross, R (2020). Ethical Issues in the New Digital Era: The Case of Assisting Driving. Book Chapter in 'Ethics, Laws, and Policies for Privacy, Security, and Liability'. Intech Publishing. DOI: 10.5772/intechopen.88371. https://www.intechopen.com/online-first/ethical-issues-in-the-new-digital-era-the-case-of-assisting-driving
- Cahill, J., Cromie, S., Crowley, K, Kay, A., & Gormley M. Advancing an 'Ethics Canvas' for New Driver Assistance Technologies targeted at Older Adults – embedding ethics in human factors design methodologies. Paper to be Presented at HCI International 2020. Copenhagen, Denmark, 19 to 24 July, 2020.
- Cahill, J., Cromie, S., Crowley, K, Kay, A., & Gormley M. Embedding Ethics in Human Factors Design & Evaluation Methodologies. Panel Presentation at HCI International 2020.Copenhagen, Denmark, 19 to 24 July, 2020.
- Cahill, J., Cromie, S., Crowley, K, Kay, A., & Gormley M. Driver persistence, safety and older adult self-efficacy: addressing driving challenges using innovative multimodal communication concepts. Paper accepted and to be presented at the 11 International Conference on Applied Human Factors & Ergonomics (AHFE 2020), San Diego, California, USA, July 16-20, 2020.

- Cahill, J. (2019). Human factors research methodologies and the specification of a Human Factors & Ethics canvas. White Paper. Centre for Innovative Human Systems, School of Psychology, Trinity College Dublin.

- Version 1, one zero one Postcast, Episode #5: Joan Cahill, TCD on The Ethical Challenges of AI. https://www.version1.com/one-zero-one/joan-cahill-ethical-ai/
- Version 1, one zero one Postcast, Episode #8: Ethics in Data Analytics

Contact

Dr Joan Cahill, CIHS, Trinity College Dublin cahilljo@tcd.ie

http://people.tcd.ie/Profile?Username=JOCAHILL
https://www.researchgate.net/profile/Joan_Cahill
Linkedin: ie.linkedin.com/pub/joan-cahill/55/513/b97/
@joanccahill
http://www.tcd.ie/cihs

Conclusion

- Assessing the ethical implications of things which may not yet exist, or things which may have impacts we cannot predict, is very difficult
- This should not be barrier to posing important questions and ensuring that these questions are addressed as part of the design process
- Thinking about both potential positive, negative consequences and unintended consequences enables designers to build in protections into the design concept
- The specification of an ethics canvas as part of a broader human factors design approach ensures that ethical issues are considered.