Design for our times: workshop 4: speculative design, AI, machine learning and design

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Speculative Design, Artificial intelligence, Machine Learning and Design

Design for Our Times: Workshop 4

Dr. Sara Diamond, June 30th, 2021
WELCOME

Dr. Sara Diamond
President Emerita OCAD University

Justine De Ridder
OCAD U Strategic Foresight and Innovation Graduate Student

Khalid Hassan
OCAD U Environmental Design Undergraduate Student

Dr. Bruno Emond
Senior Research Officer, NRC
Zoom instructions

This meeting is being recorded.

You can enable automatic close captioning.

Use the chat to ask questions and make comments.

Message one of the assistants if you have issues.

Q&A: Use the chat or raise your hand
Agenda

1. Strategic Foresight Review
2. Speculative Design
3. Industrial Design
4. AI / ML
5. Generative Design
6. AI Applications
7. Generative Design in Architecture
8. Explainable AI
9. Tools for Data Collection
10. The Future of AI
INSPIRING CANADIAN DESIGN
INSPIRING CANADIAN DESIGN
Right: Myant.ca
Left: https://makersrow.com/blog/2020/01/why-are-smart-textiles-important-for-the-2020s/
Hi Hannah
Good morning! You are on your way to hit your activity target today, you can do it!

Your Care Circle

Your Wellbeing Today

Heart Rate
Temperature
37.6 °C

Sleep Score
Activity Target
6/30 min

Coming Soon

Source: Myant report
Source: https://aginginplace.org/telehealth-and-seniors/
Close to What Matters Most

Source: https://www.facebook.com/2ndskiin/
Strategic Foresight Review
THE STRATEGIC FORESIGHT PROCESS

- scan for trends
- analyze the patterns
- theorize the impacts
- develop multiple future world scenarios
- test your strategy against the scenarios and make adjustments

Source: https://thefuturesschool.com/blog/can-you-future-proof%E2%80%8B-your-design-strategies/
What is the future of the adoption of sustainable food adoption in Canada and the market for Canadian sustainable food products?

Source: https://space10.com/project/tomorrows-meatball/
Garden City

Monocultures

Localized

Globalized

Slow growth

Biodiversity

Lab-meals

Magic mushrooms
Speculation Overview
Fiona Raby

Source: https://speculativeedu.eu/interview-dunne-raby/

Anthony Dunne
What if Arctic Ice melt increases exponentially?

What if super intelligent General AI can self-replicate?

Source: http://speculative.hr/en/introduction-to-speculative-design-practice/
What is the Speculative Design Process?

5 Distinctive Steps

1. Define
2. Ideate
3. Narrate
4. Generate
5. Respond

Source: Melany Rochester on Unsplash
Case Study

Source: https://www.crunchbase.com/organization/strange-telemetry/technology
"The first active use of speculative design in the UK government's policy processes."
50 Years of Age or older
Over 25-Year Horizon
Responded to Benefits and Drawbacks

Source: http://www.strangetelemetry.com/projects
"What changes would you want others (policymakers, local government, companies) to make if this scenario might be in your futures, or part of it?"

Source: http://www.strangetelemetry.com/projects/#/speculativedesignandageing-1
Research and analysis

Future of ageing: speculative design workshops

Report of a series of workshops exploring participants’ reactions to different aspects of an ageing population.

From: Government Office for Science
Published 6 July 2015

Source: https://www.gov.uk/government/publications/future-of-ageing-speculative-design-workshops
“In general, participants expressed greater trust in state power than corporate control. Disagreements emerged around what forms of work might be desirable to older generations, balancing the need for income; the desire to do socially meaningful and recognised work; and work which would allow them to build on their existing expertise. Participants also questioned what constituted ‘real’ interpersonal interactions – whether online or in person – with respect to types of work, service provision, and mobility”.

Research Findings
Aging in Place Challenge program

From: National Research Council Canada

The Aging in Place Challenge program will support a sustainable model for long-term care by shifting the focus toward preventive home and community-based care. The program’s objectives will focus on improving the quality of life of older adults and their personal caregivers through innovation that will support safe and healthy aging. The aim is to enable nursing homes to concentrate on older adults with the highest needs while reducing costs to the Canadian health care system.

Source: https://nrc.canada.ca/en/research-development/research-collaboration/programs/aging-place-challenge-program
QUESTIONS
Humans must look ahead seven generations
Skawennati

She Falls for Ages

Source: http://www.skawennati.com/SheFallsForAges/
"retelling of the Hauudenosaunee (Iroquois) creation story that reimagines Sky World as a futuristic, utopic space and Sky Woman as a brave astronaut and world builder."

Source: https://digitalartarchive.siggraph.org/artwork/skawennati-she-falls-for-ages/
Characters designed by participants of the Skins 7th Gen workshop at Centre d'exposition de Val-d'Or

Terra Nova, a cooperative platformer game about future Contact

Source: https://abtec.org/
INDUSTRIAL DESIGN
INDUSTRIAL DESIGN
AND THE IMPACTS OF AI/ML
AI and Machine Learning

3 types of systems: analytical
  human-inspired
  humanized artificial intelligence
machines assume and assist with human tasks because of their efficiency in processing data
“Humanized AI shows characteristics of all types of competencies (i.e., cognitive, emotional, and social intelligence), and is able to be self-conscious and self-aware in interactions with others.”
AI in industrial design

Applications of relevance to Industrial Design

• Design for the Internet of Things
• Robotic/human interfaces
• Integrating robotics into manufacturing
• AI/ML embedded systems
• Image recognition technology to identify models
• Generative design
• AI driven usability research

Source: https://uxmag.com/articles/ai-bots-and-user-research
MACHINE DESIGN. HUMAN STORY.

SHOP OUR LATEST AI COLLABS

DISCOVER HOW AI WORKS

Source: https://urbancoolab.com/
Urbancoolab is an AI-powered fashion design platform. We’re developing the future of self-expression and personal fashion for the world while pushing the limits of modern computational creativity.

Source: https://urbancoolab.com/
SHOW US YOUR DESIGN INSPIRATION
Provide up to 6 tags that best describe your design and then upload up to 6 images (from any source) to teach STICH what kind of styles you prefer.

What are some meaningful words that represent your brand and design concept?

[Add tags: machine, world, luxury, edgy, chic, human]

What are some inspirational fashion styles and graphic styles that will influence your design? Upload up to 6 images to create this small moodboard / lookbook.

You can use any imagery you’d like, don’t worry about sources, these images are for inspirational purposes only and will not appear in the final design.

Source: https://urbancoolab.com/meet-stich
Source: https://store.urbancoolab.com/collections/men
Source: https://aidaily.co.uk/articles/how-google-ai-is-making-sustainability-fashionable
Criticisms of AI in Design

AI/ML captures us in a remix of the past, relies on past formulas
Source: Sara Diamond, Ahmad Karawah, et al., 2019, TasteGraph, VAL
Criticisms of AI in Design

AI/ML captures us in a *remix of the past*, relies on past formulas without the ability to invent the future through a human lens.
Source: https://www.omnisci.com/learn/geospatial
“the process of defining high-level goals and constraints and using the power of computation to automatically explore a wide design space and identify the best design options”

Danil Nagy and Lorenzo Villaggi
Specifically-located hybridizations
- Parameter fine-tuning
- Initialization
- Evaluation
- Population management
- Operators
- Local search

Global hybridizations
- Reduction of search space
- Algorithm selection
- Hyperheuristics
- Cooperative strategies
- New types of metaheuristics

Classification
- Regression
- Clustering
- Rule mining
Design is made in reference to computational performance

Source: https://towardsdatascience.com/tagged/metaheuristics?gi=6e49b8dd33fc
Source: https://medium.com/autodesk-university/a-beginners-guide-to-designing-for-sustainability-d243eff73bfe
Figure 6.3. Generation of a shape using SG1.

Left: https://medium.com/@isohale/shape-grammars-1989ddcdeepf7
Right: http://tin.dk/design/syncity/
GENERATIVE DESIGN

Process
Generative Design Process

Define the design problem

Identify objectives best addressed by human designers
“Part of the process of parametric design is understanding what assumptions are embedded in the coding – what design is coding and what design is decision making outside of coding.”

Ana Lisa Mayboom
Generative Design Process

Define the design problem

Identify objectives best addressed by human designers

Choose metrics that describe objectives or goals
**Figure 2.** Design metrics (from left to right: adjacency preference, work style preference, buzz, productivity, daylight, and views to outside)

Greenhouse gas emissions by economic sector, Canada, 1990 to 2019

Figure 4. Plot showing clustering in input design space (color indicates design cluster)

Figure 5. Plot showing tradeoff between two objectives (color indicates design cluster)

Process Summary

1. Generate a wide design space of possible solutions through a geometry system
2. Evaluate each solution through measurable goals.
3. Evolve generations of design through evolutionary computation
GENERATIVE DESIGN
Industrial Design
(a) A300-600R Empennage

(b) Major Components of Vertical Tail Plane (VTP)

(c) VTP-Fuselage Connections

(d) Construction of Fin Near

Source: https://www.researchgate.net/figure/Vertical-Tail-Plane-Mounted-on-the-Fuselage_fig1_286375850
Aeronautical Product Development and Certification Program

From: National Research Council Canada

Source: https://medium.com/@autodesk/how-generative-design-helped-under-armour-make-its-first-3d-printed-training-shoe-975fad6573a6
Generative design and urban planning
Source: https://www.cadalyist.com/collaboration/building-information-modeling-bim/autodesk-pushes-aec-modernization-part-2-generative-
Source: https://www.cadalyist.com/collaboration/building-information-modeling-bim/autodesk-pushes-aec-modernization-part-2-generative-
"qualities of light, spatial characteristics and heritage characteristics that need to be maintained"

Source: https://sustain.sce.carleton.ca/
“create more-detailed site-layout solutions in earlier stages, and measure both hard and soft values for each option.”
QUESTIONS
How can we make AI decisions understandable?

How do we know that the data bases and the algorithms that underlie recommendation systems effectively represent diverse needs?

Do recommendations capture “weak signals”, which are behaviors and practice emerging at the edge?
AI AND MACHINE LEARNING
AI and Machine Learning

Data sets may reinforce ethnic stereotypes and preferences
   gender
   socio-economic
   racial
AI and Machine Learning

Data sets may reinforce racial stereotypes and preference

Algorithms may select information based on previous choices, excluding the underrepresented

Training data may not include real world contexts
Larger data samples are prioritized, yet small data is meaningful
“we must hold algorithms to the same standards as we hold humans”

Cathy O’Neil
The IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems

Moving "From Principles to Practice" with standards projects, certification programs, and global consensus building to inspire the Ethically Aligned Design of autonomous and intelligent technologies

The IEEE Global Initiative

The IEEE Global Initiative's mission is, “To ensure every stakeholder involved in the design and development of autonomous and intelligent systems is educated, trained, and empowered to prioritize ethical considerations so that these technologies are advanced for the benefit of humanity.”

- See a list of The Initiative's Executive and other Committees.
- Learn more about our landmark document, Ethically Aligned Design.
- FAQs and Milestones of The IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems

Source: https://standards.ieee.org/industry-connections/ec/autonomous-systems.html
Explainable AI

“individuals and publics who are subject to automatic decisions regarding employment opportunities, college and university entry acceptance, parole, investment in communities, and those who administer decisions such as judiciary, governments, and companies, have the right to understand why decisions are made”

Tim Miller
society will resist AI adoption unless there is trust in its accuracy and fairness.

Source: https://www.wsj.com/articles/make-your-job-application-robot-proof-11576492201
The more humans interact with AI algorithms, the more accurate and nuanced both the data and explanations can be.

Left: https://www.businessofapps.com/ads/facebook-ads/
Right: https://newsfeed.org/facebook-custom-audience-lists-will-need-to-adhere-to-new-requirements/why-am-i-seeing-this-ad-facebook-custom-audience/
Human in the loop

Left: Photo by Nathália Rosa on Unsplash
Middle: Photo by Alvaro Reyes on Unsplash
Right: https://www.clicdata.com/blog/the-few-the-proud-11-key-principles-of-effective-data-visualization/
Catherine Griffiths

Left: https://sfpc.io/people/catherine-griffiths/
Right: https://newsroom.cisco.com/feature-content?type=webcontent&articleId=1938827
“An algorithm is a design tool, and as such we should consider its aesthetic and visual dimensions and explore alternative expressions”

Catherine Griffiths
Slow computation

Reducing computational speed to human scale

Visualizing rule sets, not data sets

Pulling off layers of animations

Using visualization tactics to reveal the logic of a particular programming language
Visualizing Algorithms by Catherine Griffiths

Source: https://isohale.com/VISUALIZING-ALGORITHMS
Automata I by Catherine Griffiths
Mike Bostock
By looking at the structure of the [algorithmic] process and the rule sets, we are studying how the system is composed, and from here we can more easily simulate that system to execute with slightly different rules, or with a different structure, and think through what alternative outcomes are possible, or how certain results can be manipulated.”

Mike Bostock
Sorting Algorithms by Mike Bostock

Source: https://bl.ocks.org/mbostock/eb3bf12a9d02d78480c2
Graph Theory by Mike Bostock

Source: https://www.redblobgames.com/pathfinding/grids/graphs.html
Sampling Algorithms by Mike Bostock

Source: https://medium.com/@isohale/visualizing-algorithms-precedents-part-1-ce3f230d0329
Explainable AI

Builds on the work of Griffith and Bostock, and spans interpretation and transparency.

Designers ask:

What information do human decision-makers using the AI models need?

How do demands for and types of explainability vary across different predictive tasks and application domains?

How can humans guide the process to improve the explainability and accountability of the model produced?
Source: https://visualmatters.com/understanding-artificial-intelligence-data-visualization/
Partial dependence of house value on non-location features for the California housing dataset, with Gradient Boosting

Fig. 6. Projection of the last CNN hidden layer activations after training, SVHN test subset (NH: 85.02%). Insets show example observations (images) from the visual clusters.

Fig. 8. Projection of last CNN hidden layer activations after training, SVHN training subset (NH: 93.83%, AC: 99.9%).

Source: https://www.researchgate.net/publication/306049229_Visualizing_the_Hidden_Activity_of_Artificial_Neural_Networks
Visualizing Algorithmic Selection in Social Media

Meena Devii Muralikumar  
University of California, Irvine  
muralikm@uci.edu

Matthew J. Bietz  
University of California, Irvine  
mbietz@uci.edu

ABSTRACT
Social media sites such as Facebook and Twitter use algorithms to filter information in order to reduce overload and selectively pick content for users. These algorithms create unique, individual, and isolated bubbles of information that users are not always aware of. We recommend that algorithmic awareness should be the first step in addressing the pitfalls of the filter bubble effect. We conducted an experimental study to investigate how simple visualizations can be used to achieve algorithmic awareness and to understand how it might influence users’ behavior. The visualizations did not lead to increased understanding of the algorithm per se, but its presence created interesting effects that will inform future studies.

INTRODUCTION
Social media sites such as Facebook and Twitter employ algorithms to filter or rank content based on user’s previous interactions and activity. Though users have voluntarily chosen to follow posts from certain people in these applications, they only see a subset of posts that the algorithm thinks the user would be most interested in viewing.

People remain largely unaware of such algorithmic filtering or selection. Almost 60 percent of participants in a user study about Facebook’s News Feed algorithm were not aware that algorithmic selection was happening [3]. In a survey administered by Rader et al., only 26 percent of the participants

Figure 2: Interfaces for the experimental group with the visualization

Left: https://www.researchgate.net/publication/337109982_Visualizing_Algorithmic_Selection_in_Social_Media
AI AND MACHINE LEARNING
Enabling User Testing
Digital data collection and analysis tools

**Online qualitative research software**

Recollective software and services power innovative online research projects and long term communities, enabling over 700 organizations around the world to quickly unlock insights and drive success.

**All-in-one participant management for UX research**

Lightning fast participant recruiting and management for research teams who care about the right participants and the details that matter.
- descriptive and thematic analysis
- sentiment analysis
- qualitative content analysis
- typology building
- visual tools for mapping thematic relationships
- showing key words in context
- change in subjects or terminology over time
- chart workflow between team members
The next stage of automation

Transformational growth with behavioral science

We build technology to gather and interpret data that empowers businesses with game-changing insights.

Left: https://protobrand.com
Right: https://blog.sage.hr/job-interview-tools-include-ai-facial-scanning-guidelines-for-ethical-use-in-recruiting/
The next stage of automation

Left: https://www.delvinia.com/solutions/cris/
Right: https://www.methodify.it
Chat with CRIS

Hello, my name is CRIS and I’m a virtual moderator. Go ahead and tap ‘Hi’ below to get started.

Hi

What would you like me to call you?

Steve

It’s nice to meet you Steve!

I’m having chats with people to get feedback on new advertising ideas, ready to begin?

Yes

How many dogs are in your household?

None  One  Two  Three or more

Chat

How likely are you to consider buying this dog food brand based on this advertisement?

Very likely  Somewhat likely  Not very likely  Not at all likely

Chat
<table>
<thead>
<tr>
<th>Tech Geek Millennials</th>
<th>Millennial Moms</th>
<th>Environmental Millennials</th>
<th>Don't Call Me a Millennial</th>
<th>Millennials in Name Only</th>
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QUESTIONS
WE ARE BUILDING A LABOR-AS-A-SERVICE GENERAL PURPOSE ROBOT WORKFORCE
Deep Learning research
human-like intelligence that has the reasoning and affective capabilities of humans, with the processing speed and physical strength of machines

Source: https://www.techaheadcorp.com/blog/artificial-general-intelligence/
Standards of AGI and Deep Learning

Values at the center of design

Source: https://www.penguinrandomhouse.ca/books/665663/the-alignment-problem-by-brian-christian/9780393635829
Standards of AGI and Deep Learning

Values at the center of design

The search for an appropriate and negotiated containment for non-human super intelligence
We must build values into AI/ML that reflect a stakeholder driven capitalism, our society and culture.
Intelligent machine and Indigenous values

Source: https://www.indigenous-ai.net/
Making Kin with the Machines

by Jason Edward Lewis, Noelani Arista, Archer Pechawis, and Suzanne Kite
“Believing that AI has a spirit does not necessarily mean anthropomorphizing it, since being alive and having a soul does not necessarily equate to being human in Indigenous cultures.”

Drew Hayden Taylor
A key component of this would be the creation of programming languages that are grounded in nēhiyaw nisitohtamowin, in the case of Cree people, or the cultural framework of other Indigenous peoples who take up this challenge. Concomitant with this indigenized development environment (IDE) would be the goal that Indigenous cultural values were a fundamental aspect of all programming choices”.

Suzanne Kite
Immersive Learning & Opportunities for an Indigenized Tech Eco-System.
Projects

- ReadAlong Studio: Application for Indigenous audiobooks and videos
- Intelligent Plains Cree dictionary for word formation
- Indigitization
- Advancing Tâlîhôot’in language recordings, applications and technologies
- Digitizing Ñsîsilxw̓ Elder recordings
- Creating video recordings of Yukon Indigenous languages
- Mohawk verb conjugator and related technologies for Indigenous languages
- Predictive text software for Indigenous languages
- Segmenting and indexing audio recordings of Indigenous languages

Left: https://nrc.canada.ca/en/research-development/research-collaboration/programs/canadian-indigenous-languages-technology-project
Right: https://nrc.canada.ca/en/research-development/research-collaboration/programs/artificial-intelligence-design-challenge-program
REVIEW
2. PROBLEMS / PAINS

Which problems do you solve for your customer?

There could be more than one, explore different ones:

e.g. existing solar solutions for private houses are not considered a good investment (1).

TWO MANY POINTS FOR COMPARISON
Hard to coordinate

TWO MANY

TABS

X

Photo by Daria Nepriakhina on Unsplash
The 5 stages of Design Thinking

- Empathize
- Define
- Ideate
- Prototype
- Test
THE STRATEGIC FORESIGHT PROCESS

- scan for trends
- analyze the patterns
- theorize the impacts

- develop multiple future world scenarios

- test your strategy against the scenarios and make adjustments

Source: https://thefuturesschool.com/blog/can-you-future-proof-your-design-strategies/
QUESTIONS
THANK YOU