CU04 Digital Twin CU03 Smart Grid

I Trust AI Plenary National Library and Archives, Abu Dhabi Research Plenary Meeting, Day 2

> Tracey P. Lauriault (remote) Associate Professor, Critical Media & Big Data School of Journalism & Communication Carleton University, Ottawa (ON) Canada orcid.org/0000-0003-1847-2738 <u>Tracey.Lauriault@Carleton.ca</u> @TraceyLauriault



Tracey P. Lauriault, I Trust AI International Symposium, National Library and Archives, Abu Dhabi, 22/02/2023

TOC

- •CU04 Digital Twin Case Study
- •CU03 Smart Grid Case Study
- Methodology
- Conclusion



Ya8



8.2.3 M 5.2.9





Tracey P. Lauriault, I Trust AI International Symposium, National Library and Archives, Abu Dhabi, 22/02/2023

Urban Digital Twin

- An ecosystem of multi-dimensional and interoperable subsystems of
 - things in the real world, natural & human made
 - a digital replica of those things
 - a system that communicates between the digital and the real-world things, and
 - the people and institutions that govern, contribute to, use and share it
- Primarily w/in architecture, engineering, construction, and operations (AECO)







Tracey P. Lauriault, I Trust AI International Symposium, National Library and Archives, Abu Dhabi, 22/02/2023





CS04 - Digital Twin



Imagining Canada's Digital Twin



 Sustain Digital Campus project conducted experimentation in 4 test buildings at Carleton U.

- 8 BIM buildings at Carleton U.
- DT ecosystem of technologies & data allows Architecture, Engineering, Construction, and Operations (AECO) professionals analyze real-time data and visualize the modeling and analysis results into their actual designs, improving the overall process and to manage these assets.



CU04 – Digital Twin Objectives

- •A case study to understand how a digital twin is used and created so that it can be preserved
- •Test the preservation of the Carleton University Digital Twin created as part of the digital campus work at the Carleton Immersive Media Studio (CIMS) and the Sustain Project
- •By doing so, is it possible to use AI to automate the preservation of digital twins and related technologies
- •How can DT AI/ML + IoT be preserved



CS04 - Digital Twin

- 1. Provides critical records and archival challenges in terms of the use and creation of complex records – **BIM, ASM, Digital Twins, VR and AI**
- 2. Involves and ecosystem of data, real-time systems, AI/ML, IoT, building information systems (BIM), asset management systems (AMS), LIDAR, VR, simulations and techniques, technologies, and data of importance to fields in architecture, urbanism, planning, construction and engineering.
- 3. Archival concepts of authenticity, reliability, and accuracy, and others will be identified as research progresses.



Tracey P. Lauriault, I Trust AI International Symposium, National Library and Archives, Abu Dhabi, 22/02/2023

Digital Twin Team

Communication & Media Studies	Carleton University	Associate Professor, Critical Media and Big Data	Tracey P. Lauriault	Canada
School of Information Resource Management	Renmin University of China	Associate Director, Center for Electronic Records Management Research	Sherry Xie	China
Carleton Immersive Media Studio (CIMS)	Carleton University	Director CIMS Lab	Stephen Fai	Canada
Carleton Immersive Media Studio (CIMS)	Carleton University	PhD Candidate	Nicolas Arellano	Canada
Corporate Records and Archives	Carleton University	MLIS, Digital Archivist	Travis Kinnear	Canada
Department of Computer Science, Electrical and Space Engineering	Luleå University of Technology	Information systems, Digital Services and Systems,	Tero Päivärinta	Sweden
Dept. of Information Systems and Technology (IST) and Information Specialists		The Swedish Transport Administration	Göran Samuelsson	Sweden
Professor in Architectural Conservation and Sustainability Engineering	Carleton University	SUSTAIN Project (Sensor-based Unified Simulation Techniques for Advanced In-Building Networks)	Liam O'Brien	Canada
Department of Civil and Environmental Engineering	Carleton University	SUSTAIN Project (Sensor-based Unified Simulation Techniques for Advanced In-Building Networks)	H. Burak Gunay	Canada
Dipartimento di Storia, Archeologia, Geografia, Arte e Spettacolo - SAGAS	University of Florence (UNIFI)	Professor	Annantonia Martorano	Italy
Computer Science	Carleton University	Professor and Director	Michel Barbeau	Canada



o.....

Tracey P. Lauriault, I Trust AI International Symposium, National Library and Archives, Abu Dhabi, 22/02/2023



8 Z 8 M i / X -



CS03 - Smart Grid Data Communication and Analytics Prediction Engine

- Smart grids monitor energy consumption and manage production and distribution using a variety of AI/ML & algorithms to predict consumption to manage the grid at power generation but also at the individual household w/ billing and consumption information
- A common central element in most smart city strategies, smart grids must address archival and record keeping concerns in order to support the accountability of decision-makers and transparency to clients/consumers





CS03 - Smart Grid Case Study



- The Sensor Systems and The Internet of Things Lab at Carleton University conducts research with the Ontario Smart Grid that uses AI/ML in its IoT System
- Inform how archival concepts and principles can influence the development of responsible AI; and will enable outcomes to be validated
 - A source of information for other studies in connection with explainable AI, creation, use, retention, and preservation.
 - Important implications for utilities worldwide, for instance for The Ontario Smart Grid System





CS03 – Smart Grid Objectives

- 1. To provide critical insights into the accountability of a major utility
- 2. Findings will clarify the degree to which AI/ML implementations of this scope and complexity are "explainable" to decision-makers and consumers
- 3. Good practices identified can be communicated to other jurisdictions and utilities considering similar ML-based enhancements
- 4. Analyze the juridical, provenancial, and procedural contexts of ML-based improvements



Smart Grid Team

Communication & Media Studies	Carleton University	Associate Professor Critical Media and Big Data	Tracey P. Lauriault	Canada	
School of Information Resource Management	Renmin University of China	Associate Director, Center for Electronic Records Management Research	Sherry Xie	China	
Department of Systems and Computer Engineering	Carleton University	CISCO Chair in the Internet of Things & Director Internet of Things Lab	Mohamed Ibnkahla	Canada	
Department of Systems and Computer Engineering	Carleton University	Cisco Chair Manager, Internet of Things Lab, Department of Systems and Computer Engineering	Zied Bouida	Canada	
I Trust Al	I Trust Al	Retired archivist, considerable archival and program management experience in the public sector	Jim Suderman	Canada	
Faculty of Humanities and Social Sciences	University of Zagreb		Sanja Seljan	Croatia	
MacOdrum Library	Carleton University	Head, Archives & Special Collections	Chris Trainor	Canada	
Computer Science	Carleton University	Professor and Director	Michel Barbeau	Canada	M





8 Z 8 M 1 / A 8





Tracey P. Lauriault, I Trust AI International Symposium, National Library and Archives, Abu Dhabi, 22/02/2023

Walkthrough Method

Article	
The walkthrough method:	new media & socie 2018, Vol. 20(3) 881–91 © The Author(s) 20
An approach to the study	Reprints and permission sagepub.co.uk/journalsPermissions.n DOI: 10.1177/146144481667543
or apps	(\$SAGI
Ben Light University of Salford, UK	
Jean Burgess	
Queensland University of Technology, Australia	
Stefanie Duguay	
Queensland University of Technology, Australia	



Juridical-Administrative ²	Technological ³
Provenancial ⁴	Vision
Procedural ⁵	Governance
Documentary ⁶	Management



mail: b.light@salford.ac.u

Sample of CIMS DT Data & Technology





Semi Structured Interviews

InterPARES I Trust AI **Draft Case Study Questionnaire** February 2023 CU04 Building and Creating a Digital Twin for Preservation8 CU03 Smart Grid Data Communication and Analytics Creation and Use + Special Cases Cluster Tracey P. Lauriault Sherry Xie Associate Professor Professor, School of Information Resource Critical Media and Big Data Management School of Journalism and Communication Associate Director of the Center for Electronic Records Management Research, Carleton University Renmin University of China, Beijing Ottawa (ON) Canada sherrylx@outlook.com Tracey.lauriault@carleton.ca

- •Adapted IP2 Case Study Questionnaire
- •Consulted with Day 1 Plenary Attendees in Abu Dhabi, 21/02/2023
- •Will circulate and seek input for the next couple of weeks
- Modify it
- •Consult with Carleton Archivists
- •Plan to schedule Interviews in April



CUREB

6. Failure to conduct the research in accordance with the principles of the *Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans 2nd edition* and the *Carleton University Policies and Procedures for the Ethical Conduct of Research* may result in the suspension or termination of the research project.

Upon reasonable request, it is the policy of CUREB, for cleared protocols, to release the name of the PI, the title of the project, and the date of clearance and any renewal(s).

Please email the Research Compliance Coordinators at <u>ethics@carleton.ca</u> if you have any questions.

CLEARED BY:

Date: February 17, 2023



Office of Research Ethics 4500 ARISE Building | 1125 Colonel By Drive Ottawa, Ontario K1S 5B6 613-520-2600 Ext: 2517 <u>ethics@carleton.ca</u>

CERTIFICATION OF INSTITUTIONAL ETHICS CLEARANCE

The following research has been granted clearance by the Carleton University Research Ethics Board-A (CUREB-A). CUREB-A is constituted and operates in compliance with the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS2).

Ethics Clearance ID: Project # 118766

Project Team Members: Dr. Tracey Lauriault (Primary Investigator) Sherry Lie Xie (Co-Investigator (External))

Study Title: Archives 4.0: Artificial Intelligence for Trust in Records and Archives -InterPARES Trust AI (I Trust AI)

Funding Source: (If applicable):

Effective: February 17, 2023

Expires: February 29, 2024

This certification is subject to the following conditions:

- 1. Clearance is granted only for the research and purposes described in the application.
- 2. Any modification to the approved research must be submitted to CUREB-A via a Change to Protocol Form. All changes must be cleared prior to the continuance of the research.
- 3. An Annual Status Report for the renewal or closure of ethics clearance must be submitted and cleared by the renewal date listed above. Failure to submit the Annual Status Report will result in the closure of the file. If funding is associated, funds will be frozen.
- 4. During the course of the study, if you encounter an adverse event, material incidental finding, protocol deviation or other unanticipated problem, you must complete and submit a Report of Adverse Events and Unanticipated Problems Form.
- 5. It is the responsibility of the student to notify their supervisor of any adverse events, changes to their application, or requests to renew/close the protocol.



Data Capture

- Audio video recording of systems and how they operate
- Interview recordings and transcripts
- Document collection
- Inventory:
 - Data
 - AI/ML
 - Software
 - Hardware

 Test the preservation of the Digital Twin and the Smart Grid in the Carleton University Archives





828W1/X-



I Trust AI Case Studies

- Methodological approach to the study of large complex social and technical systems that include AI/ML
- Identify how records for decision making are created in these dynamic & interactive systems
- Test the preservation of these systems and their records, possib
- Preservation Guidelines for Digital Twin and Smart Grid
 - creators
 - software & hardware developers
 - governments





Tracey P. Lauriault, I Trust AI International Symposium, National Library and Archives, Abu Dhabi, 22/02/2023

Projects

InterPARES Trust AI, UBC Canada

 Funded by the Social Sciences and Humanities Research Council of Canada, <u>https://interparestrustai.org/trust</u>, @itrustai

Imagining Canada's Digital Twin,

- Carleton Immersive Media Studio (CIMS), Carleton University, Canada
- funded by the New Frontiers in Research Fund (NFRF), https://canadasdigitaltwin.ca

Sustain Designing for People

- Carleton University, Canada
- funded by NSERC, <u>https://sustain.sce.carleton.ca/</u>

Sensor Systems and Internet of Things Lab,

- Department of Systems and Computer Engineering, Carleton University, Canada
- Funded by CISCO and others <u>https://carleton.ca/internetofthings/people/dr-mohamed-ibnkahla/</u>



Image Source CS04 & CS03



- Cover Slide CIMS <u>http://cims.carleton.ca/#/projects/imagining_canada's_dig</u> <u>ital_twin</u>
- Zied Bouida, <u>Sensor Systems and The Internet of Things</u> Lab presentation at the WG1 Meeting on October 25, 2021
- •Nicolas Arellano, <u>Carleton Immersive Media Studio</u> (CIMS) and the presentation at the WG1 Meeting on October 25, 2021

• Contact:

- <u>Tracey.lauriault@carleton.ca</u>
- @TraceyLauriault

