The Doctoral School Multidisciplinary Symposium

DSMS 2023

HORIZONS FOR HUMANITY

University of Strathclyde Glasgow

DRG Doctoral Researchers Group

UNIVERSITY of STRATHCLYDE DOCTORAL SCHOOL

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Chair's Welcome

A warm and heartfelt welcome to all of you gathered here at **DSMS 2023**! It is a tremendous honour to stand before such a diverse and vibrant audience. Fellow colleagues PGRs have tuned in from University of Strathclyde campuses and field work facilities from as far as East Asia, North America, and Africa, to engage in a multidisciplinary research discussion about "Where the next horizons for humanity lie?". Before, we venture into the main topic of our research discussion, let us look at what brings us today in this event.

Five years ago, a small group of PGRs organised a university wide research symposium which has since flourished through collaboration with their co-founding staff members. Their ambition to create a safe space for developing research culture and enhancing the research community experience propelled the project's growth. This platform empowers PGRs, to shape the peer-review culture, develop communication skills, creatively engage with a wider audience, pursue leadership opportunities, and find teamwork experience. DSMS thrives due to the combined value it offers and the PGRs' dedication to sharing their research knowledge with others, driven by their purposeful endeavours.

I would like to thank the founders and the organising committees for the smooth continuous transfer of knowledge and experience over the years. Those include DRG alumni and the wonderful staff members in the Strathclyde Doctoral School. A special shout out to Professor Eleanor Shaw and Dr Stephanie Colvan who have provided critical support from the inception of DSMS. This year in particular, I would like to personally thank the talented, persevering and creative members of the wonderful DSMS 2023 Organising Committee. The Doctoral Researchers Group PGRs sitting on the committee and Strathclyde Doctoral School members have transformed the feedback collected from participants and alumni into this year's fabulous DSMS. I want to thank them for their achievement! Next, I would like to thank a long list of committed, innovative researchers - the PGRs, who have prepared over a hundred oral (70+) and poster (30+) presentations, and the 88 critical peer-reviewers for their time to help each abstract to reach its full potential. In addition, thank you to the twenty-six volunteers and ten session chairs for your time and efforts to contribute to the smooth-running of the symposium. Finally, thank you to our patrons - the faculty deans and vice deans, the recruitment and international office, the alumni fund, and the student union for believing in and supporting us!

We have gathered to find out where the next horizons for humanity lie in four distinct topics: Solutions for Sustainability, Inclusive Communities and Policies Understanding, Impactful Entrepreneurship and Innovation and Healthier Humanity. You are able to find answers to the above topics in 18 one-hour long presentations and a flash talk poster session and four brilliant keynote sessions throughout the next two and a half days.

We are grateful to welcome four wonderful Keynote speakers: Dr Geetha Marcus - Senior lecturer at the University of Edinburgh, Dr Aleksandra Bavdaž- Lecturer in Entrepreneurship at the University of Glasgow, Prof. Massimiliano Vasile - Professor of Space Systems Engineering and Director of the Aerospace Centre of Excellence at the University of Strathclyde, and last but not least Prof. Tracy Morse, Head of the Centre for Sustainable Development and Professor in Civil and Environmental Engineering at the University of Strathclyde.

With this, I hope you all enjoy the symposium and that you take advantage of these two and a half days to connect with your peers, discover the wealth of research taking place at the university and most importantly have fun!

Ivan Yankov

Chair of DSMS 2023

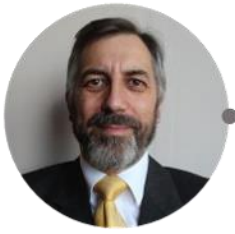
DSMS 2023 Organising Committee

Doctoral Researchers Group

Ivan Yankov
2nd year PhD
Pure and Applied Chemistry

Elita Chamdimba
2nd year PhD
Social Work and Social Policy

Kieran Redpath
2nd year PhD
Pure and Applied Chemistry



David Scott
2nd year PhD
Hunter Centre for Entrepreneurship

Dalia Aly
PhD
Architecture

Laura Moldovan
1st year PhD
Architecture

Shahrzad Zeinali
1st year PhD
Architecture

Samuel Etopidiok
1st year PhD
Architecture

Michail Dellepiane
3rd year PhD
Mechanical and Aerospace Engineering

McRhon Banderlipe
1st year PhD
Education

Valerie Ingram
2nd year PhD
Hunter Centre for Entrepreneurship

Laure Vidal--Roussel
2nd year PhD
Biomedical Engineering

DSMS 2023 Organising Committee

Strathclyde Doctoral School

Eleanor Shaw
Strathclyde Doctoral School

Stephanie Colvan
Strathclyde Doctoral School

Victoria Royle
Strathclyde Doctoral School

Lynn McHugh
Strathclyde Doctoral School

Shannan Donald
Strathclyde Doctoral School

Gabrielle Milson
Strathclyde Doctoral School

Further Acknowledgements

- Kobe Hoi-Yin Yung – PhD Student - Naval Architecture, Ocean and Marine Engineering
- Katya Paliwoda – PhD Student – Strathclyde Business School

DSMS 2023 Partners

The University of Strathclyde faculties

Strathclyde Student Uni Association (SU)

Phil Reavey

Harriet Henshall

Tally Kerr

SU staff

RIO - Recruitment and International Office

Gordon Dunlop - senior international recruitment office

Paul Shannon - social media office

The RIO team

University of Strathclyde Alumni Fund

University of Strathclyde Alumni Fund

@strathclydealumni @strathclydealumnicommunity #StrathAlumniFund

Every year the Strathclyde Alumni Fund support student-led projects, clubs and societies with generous donations from former students who want to reach back and help current students. The Alumni Fund is supporting the DSMS this year which helped the organising committee to arrange the event that will host more than x PhD students and other delegates. The event will allow students to showcase their research and connect with other researchers, through x oral presentations, x poster presentations, and 4 keynote speaker presentations. The symposium is also hosting a PhD Taster workshop that will allow current PhD students to share their experiences with potential new PhD students.

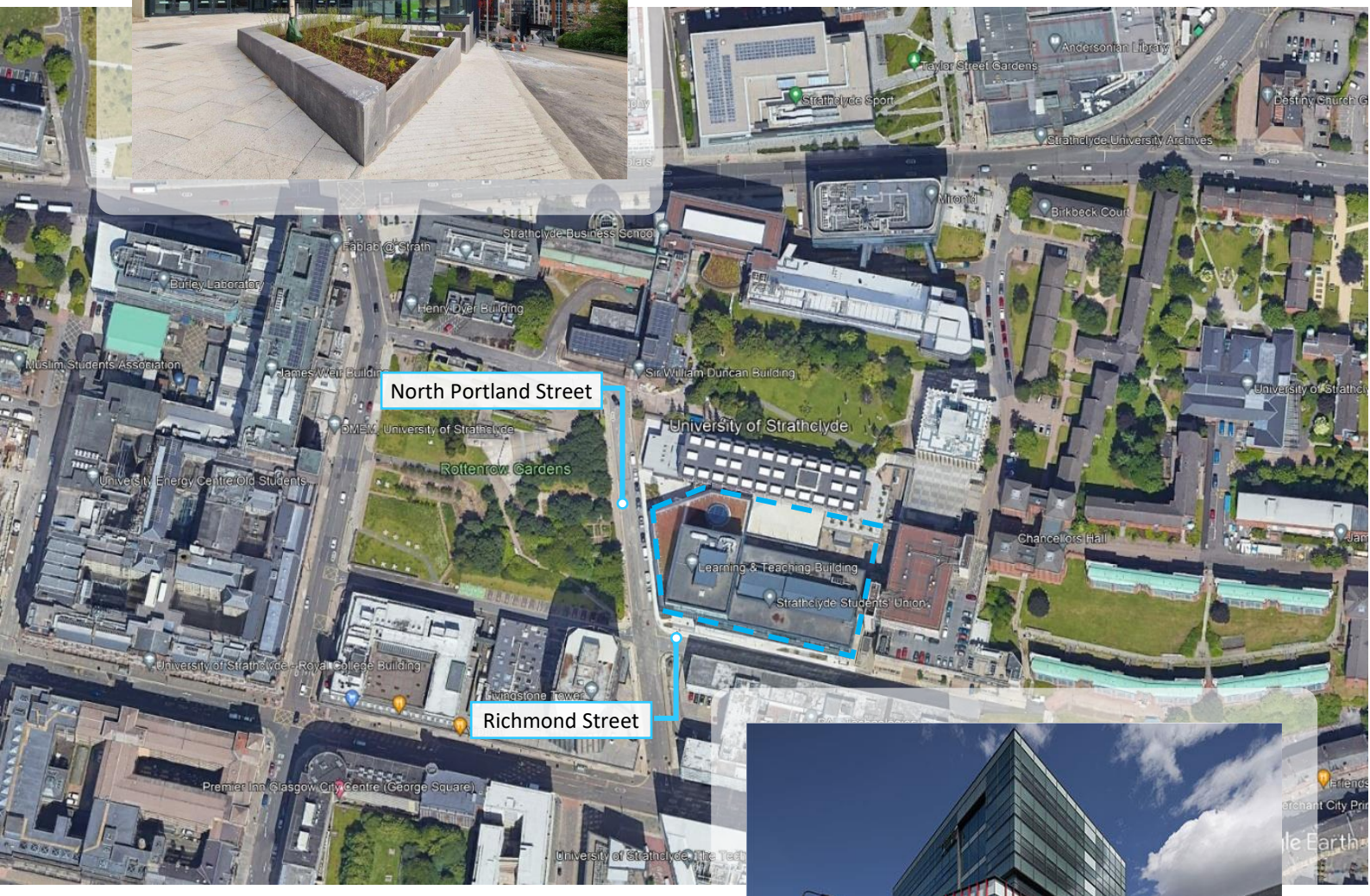
https://www.strath.ac.uk/alumni/givetostrathclyde/alumnifund/enhancingthestudentexperience/

Map and Access

The symposium will take place in the Learning and Teaching Building on the University of Strathclyde University campus. The building is around 10 minute walk from Buchanan Street Subway Station, the Buchanan Bus Station and Queen Street Station, and a 15 minute walk from Glasgow Central Station.

The building can be accessed via North Portland Street and via Richmond Street as shown on the map below. We recommend accessing the building via North Portland Street as this will bring you straight to the 3rd floor where the registration desk will be located, and the presentations will take place.

North Portland Street Entrance



Richmond Street Entrance

Online Access

The symposium will also feature a Zoom meeting hosting up to 300 people at one time. A main lobby will be used for all major events which include - workshop events, keynote talks and opening/closing ceremonies. Three breakout rooms will be organised for hosting individual presentation sessions in parallel. Delegates are free to move in between rooms to attend the session they like.

Housekeeping rules:

- Please log into the meeting 5 minutes before the start of each major event (opening/closing ceremony, keynote talks and workshops). A waiting room will be in place to minimise disruptions during main events. Readmission will continue after.
- Breakout rooms will hold parallel presentations session.
- Delegates are allowed to move in between breakout rooms during the Q&A of each talk.
- Follow instructions from session chairs when in a presentation session.
- Be considerate of others who are speaking by staying muted. If you want to speak up or ask a question, please first raise a hand or use the chat box.
- The sessions will be recorded. Be mindful when switching on your video.

Zoom login details:

Ivan Yankov is inviting you to a scheduled Zoom meeting.

Topic: **Doctoral School Multidisciplinary Symposium DSMS 2023 June 14-16**

Time:

Jun 14, 2023 09:30 AM London duration 8 hours

Jun 15, 2023 09:30 AM London duration 8 hours

Jun 16, 2023 01:30 PM London duration 4 hours

*******DO NOT SHARE MEETING INVITES ON SOCIAL MEDIA*******

Join Zoom Meeting

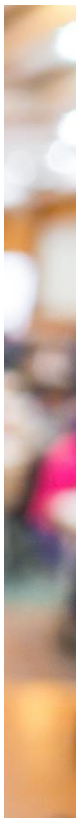
https://strath.zoom.us/j/87685829461

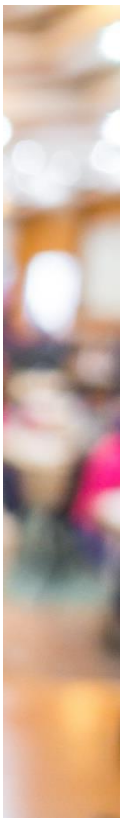
Meeting ID: 876 8582 9461

Password: 894172

PhD Taster workshop (Requires separate Zoom link, details below)

Keynote Speakers





Dr Geetha Marcus

Geetha Marcus is a sociologist, feminist and teacher activist whose research and teaching interests focus on social inequalities within public education systems. She has extensive professional experience in the field of primary education, both in classroom practice and in senior management, and in 2016 published a study for the Scottish Parliament, 'Closing the Attainment Gap', on educational achievement and equity. As a practitioner-researcher, she believes there is an urgent need for teachers to employ education methods that effect justice-oriented social change.

Her book Gypsy and Traveller Girls: Silence, Agency and Power (2019) critically explores and documents the racialised and gendered experiences of Gypsy and Traveller girls in Scotland, within public spaces of school and private spaces of home; and she continues to highlight the ongoing legacies of anti-Gypsy violence (Marcus, 2023). Most recently, she co-edited a book on Anti-Racism in Education (Marcus & Van de Peer, 2023). As a South Asian and advocate of black feminist thought and methodology, Marcus' work also explores the multiple identities and experiences of young people and women on the margins from a postcolonial perspective.

Wednesday 14th of June, 12:30, Room TL325

Dr Aleksandra Bavdaz

Aleksandra Bavdaz is a lecturer of Entrepreneurship at Glasgow University, with a strong background and two degrees in Business Accounting and Finance and wide array of practical and academic experience in digital marketing and entrepreneurship.

Aleksandra is currently leading two projects – Authentic Leadership, funded by University of Glasgow and Ocean Monitoring through sensing technologies, in collaboration with UKRI, ESA, The Data Lab and CENSIS UK. The first is looking at the practices of authentic leading within an entrepreneurial context. While the second project is tackling the issue of overfishing aiming to provide a technological solution to foster understanding of ocean resources and helping to restore them faster than they are getting extinct.

Prior to her current roles, Aleksandra worked in various marketing and leadership positions, where the most recent one was in Amazon Advertising. There she was a senior account manager at a global digital agency, building advertising strategy and looking after world-known clients in the gaming industry, such as Razer and garment industry, such as UGG. In her previous research, Aleksandra explored advertising practice, specifically advertising technology, through spending several months in UK based digital marketing agencies, studying advertising strategy practice in hospitality industry and building strategy for various clients in the same sector. On the social side, Aleksandra spent a couple of years on the committee, in a leading position of a Glasgow-based dancing society that engages with charitable projects through Water Aid UK, aiming to improve water facilities and water access across Africa.

Thursday 15th of June, 12:30, Room TL325

Prof. Massimiliano Vasile

Massimiliano Vasile is currently Professor of Space Systems Engineering and Director of the Aerospace Centre of Excellence at the University of Strathclyde.

He received his M.S. in 1996 and Ph.D. in 2001 from Politecnico di Milano. He sits on the AIAA Astrodynamics and IAF Space Power committees, and chairs the IEEE task force on Emerging Technologies in Space and Aerospace. He is scientific adviser to the UK delegation to UNOOSA and sits on the UN Space Mission Planning Advisory Group. His research interests include Computational Astrodynamics, Space Sustainability, Computational Intelligence and Optimisation Under Uncertainty exploring the limits of computer science at solving highly complex problems in science and engineering. Asteroid 2002 PX33 “Maxvasile” was named in his honour in recognition of Prof Vasile’s contributions to the development of innovative techniques for the design and optimisation of space trajectories and his work on asteroid manipulation.

Prof. Vasile has developed novel numerical methods for single and multi-objective optimisation under uncertainty, has pioneered the use of computational intelligence in astrodynamics, and the use of imprecise probability theories in the optimisation of space systems. His research has been funded by the European Space Agency, the UK and French Space Agencies, the Engineering and Physical Sciences Research Council, the Planetary Society and the European Commission.

He is an AIAA associate fellow and an IEEE senior member.

Thursday 15th of June, 14:30, Room TL325

Prof. Tracy Morse

Tracy Morse is the Head of the Centre for Sustainable Development and a Professor in the Civil and Environmental Engineering Department at the University of Strathclyde. Having previously been based in Malawi for 20 years, she leads an interdisciplinary research team with a focus on addressing the determinants of health in low- and middle-income countries.

Her research projects in Malawi and across the region have focused on preventive community health with a particular emphasis on water, sanitation, hygiene (WASH), food safety, air quality, maternal and reproductive health, and community development models.

Tracy is a Visiting Professor at the Malawi University of Business and Applied Sciences, as well as sitting on the Board of the Scotland Malawi Partnership. She was a recipient of the Strathclyde Medal in 2015 and part of the winning Student Engagement team at the 2022 Green Gown Awards.

Based on their needs and priorities, Tracy works with partners globally. She is driven to promote the importance of transdisciplinary research in addressing sustainable development for all, and supporting the transformational change needed to support attainment of UN SDGs.

Friday 16th of June, 14:00, Room TL325

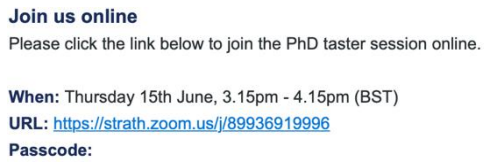
PhD Taster Workshop

PhD Taster workshop
(separate registration and access link required)

1) Go to Study with us: Postgraduate research webpage. *https://www.strath.ac.uk/studywithus/postgraduateresearch/#*
2) Click Register for workshop Under PhD taster workshop (scroll down, on the right)
3) Register and you will receive an email with the webinar details and passcode

2

3



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University of Strathclyde

DSMS 2023 SYMPOSIUM
PRESENTS

PhD TASTER WORKSHOP

DRG Doctoral Researchers Group

SPEAKERS

DOCTORATE STUDENTS FROM ALL OUR FACULTIES

ENGINEERING
ELECTRONIC & ELECTRICAL ENGINEERING
CHEMICAL & PROCESS ENGINEERING

BUSINESS
MARKETING

SCIENCES
INSTITUTE OF PHARMACY & BIOMEDICAL SCIENCES

HUMANITIES& SOCIAL SCIENCES
PSYCHOLOGICAL SCIENCES & HEALTH
LAW

HAVE YOU EVER CONSIDERED GETTING A PHD?

COME JOIN US TO...

- ✓ Hear first-hand experiences of PhD life
- ✓ Learn how to land a PhD position
- ✓ Find out how to overcome potential barriers

GET YOUR QUESTIONS ANSWERED AT THE LIVE Q&A SESSION AFTER THE EVENT!

15TH OF JUNE
3:15PM

Learning And Teaching Building
Level 3 Lecture Theatre 325 A&B
Glasgow G1 1XU

MORE INFO AT
doctoralresearchersgroup@strath.ac.uk
/DRGStrath
@DRGStrath

Meet our SPEAKERS!

Liam Moorhouse is a 1st year MPhil researcher at the Faculty of Humanities and Social Sciences, Law Department, and will be speaking about **“Research paths to a PhD”.**

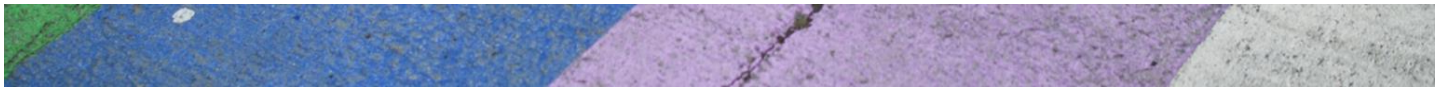
Marco Bonfanti is a 3rd year PhD researcher at the Faculty of Science, Strathclyde Institute of Pharmacy and Biomedical Sciences, and will be speaking about **"Choosing the right supervisor".**

Lucas Nahas is a 1st year PhD researcher at the Faculty of Engineering, Chemical and Process Engineering Department, and will be speaking about **“Industrial PhDs and Centres for Doctoral Training”.**

Dolly Sunilkumar is a 4th year PhD researcher at the Faculty of Humanities and Social Sciences, Psychological Sciences and Health Department., and will be speaking about **“Marketing your PhD”.**

Victor Timmers is a 3rd year PhD researcher at the Faculty of Engineering, Electronic and Electrical Engineering Department, and will be speaking about **“Industry-sponsored PhD”.**

Amy Grech is a 1st year PhD researcher at the Faculty of Engineering, Design, Manufacturing and Engineering Management Department, and will be speaking about **“Challenges and opportunities as an international students”.**



Themes

SOLUTIONS FOR SUSTAINABILITY

Cross-cutting and novel interdisciplinary approaches which feature sustainable solutions, design, science and technology to sustain life on, above and beneath the earth.

Addressing sustainability-related challenges requires interdisciplinary solutions fostered through the collaboration of disciplines, integrating and boosting science and technology-based capabilities. Design, a key principle that permeates these solutions, can drive democratic, participatory and innovative approaches to sustain life above and below water. Harnessing wind energy, aerospace capabilities, marine and ocean life, among many others have been at the forefront of the University's commitment to work with industry partners and have fuelled top-notch collaborations while achieving real global impact.

Inclusive Communities and Policies

Understanding localised, place-based, community challenges, policies, and intersections which drive local, regional, national and international collaborations, connectivity and networks.

As a global community, the University is home to students representing various nationalities, cultures and socio-economic and political contexts. The diversity of attributes has enabled the University to encourage research that fosters inclusivity, representation and voice. These are reflected in the research projects which link communities together, celebrating cultural divergences and nuances, and nurturing active and supportive ways of thinking, living and working together. Institutions which drive governance and policies have to be working together; and it brings the question of how our research can catalyse and foster dialogue, discourse and delivery of critical public services.

Impactful entrepreneurship and innovation

Broadening access to inclusive skills development, economic participation and opportunities for everyone.

Cliché as it seems, the Fourth Industrial Revolution is already here. The development of AI and machine learning enabled platforms continue to disrupt our daily lives. This has also led to the development of mechanisms that democratise and afford access to services, jobs and talent. Amidst the neoliberal and market-based backdrop, there are spaces within research that can drive inquiry, action and participation to achieve equitable, inclusive and socially just outcomes.

Healthier Humanity

Scaling solutions in the areas of healthcare, pharmacy, environment and marine where collaboration, networks and participation are essential to promote healthier individuals, communities and societies.

Changing lifestyles, environment and climate have led to various enquiries about the current state of health in general. Science-based, community-driven, and socially inclusive research can provide a plethora of possibilities for broad-based and asset-based solutions towards health. Managing life transitions, environmental and social health are important to ensure we promote liveable and healthy individuals, communities, and societies.

Full Schedule

Day 1 - Wednesday 14th of June

(Z: Zoom Presentation)

09:00	Registration (Level 3 Teaching and Learning Building)			
09:15				
09:30				
09:45	Seating			
10:00	Chairs Welcome and Message from Stephanie Colvan (Room TL325 a&b)			
10:15				
10:30	Break			
Session 1				
	TL423	**TL325 a&b**	**TL329**	**TL324**
10:45	(Z) *Shabadini Sampath*	*Eugene Asante*	*Mengyi Mei*	Satellite room/ Private space
11:00	*Jonathan Conn*	*Nura Umar*	*Feline Fehring*	
11:15	*Anna Gribbon*	(Z) *Brenda Morrison*	(Z) *Juraj Sikra*	
11:30	*Ross Urquhart*	(Z) *Karim Osouli Bostanabad*	*Sonya Fonweban*	
11:45	*Ubong Essien*	*Liam Moorhouse*	*Fitri Berutu*	
12:00	*Stuart Clark*	*Issah Imoro*	*Andrew Currie*	
12:15	Break			
12:30	Keynote Speaker: Dr Geetha Marcus (Room TL325 a&b)			
12:45				
13:00	Lunch / Display Images of Research			
13:15				
13:30				
13:45				
Session 2				
	TL423	**TL325 a&b**	**TL329**	**TL324**
14:00	*Ewan McRobert*	(Z) *Anya Kaufman*	*Jois Stansfield*	Satellite room/ Private space
14:15	*Marianella Bolivar Carbonell*	*Bohdana Schwendtner*	*Stuart Bagnall*	
14:30	*(Z) Frank Ndiata*	*Saba Aslam*	*Erica Zuniga*	
14:45	*Susan Brush*	*(Z) Donna Meadows*	Karyn Mabon	
15:00	Break			
15:15	*Hamish Swanson*	*Jai Geelal*	(Z) *Nitiwate Meesonk*	Satellite room/ Private space
15:30	*Muftah Abu Obaida*	*Harry Patria*		

Day 1 - Wednesday 14th of June

(Z: Zoom Presentation)

15:45	*(Z) Frederick Ebili*	*(Z) Wafa Alwafi*		
16:00	*Chinyere Ekperechukwu*			
Booking The garden (Student Union)				

Day 2 - Thursday 15th of June

(Z: Zoom Presentation)

09:00	Registration (Level 3 Teaching and Learning Building)			
09:15				
09:30				
09:45	Seating			
Session 1				
	TL423	**TL325 a&b**	**TL329**	**TL324**
10:00	*Nagehan Kaya Balkaya*	*Kullapat Chaiyawat*	*Phindu Lipenga*	Satellite room/ Private space
10:15	*Athanasios Karampourniotis*	*Samuel Etopidiok*	*Yan Wang*	
10:30	*Oyedotun Oyewole*	*Suleyman Kahraman*	Ridvan Ayhan	
10:45	*Shahrzad Zeinali*	*Andrew Porter*	(Z) Arnida Binti Jahya	
11:00	Break	*Callum Davidson*	Break	
11:15	Poster session (Room TL328)			
11:30				
11:45				
12:00				
12:15	Break			
12:30	Keynote Speaker – Dr Aleksandra Bavdaz (Room TL325 a&b)			
12:45				
13:00	Lunch / Display Images of Research			
13:15				
13:30				
13:45				
14:00				
14:15	Seating			
14:30	Keynote Speaker: Prof. Massimiliano Vasile (Room TL325 a&b)			
14:45				
15:00	Break			
15:15	**PhD Taster** Workshop (Room TL325 a&b)		**DRG** Workshop (Room TL329)	
15:30				
15:45				
16:00				

Day 2 - Thursday 15th of June

(Z: Zoom Presentation)

Booking The garden (Student Union) Networking session post PhD Workshop and DRG Workshop (16:15:19:00)

Day 3 - Friday 16th of June

(Z: Zoom Presentation)

13:30	Registration (Level 3 Teaching and Learning Building)			
13:45	Seating			
14:00	Keynote Speaker: Prof. Tracy Morse (Room TL325 a&b)			
14:15				
Session 1				
	TL423	**TL325 a&b**	**TL329**	**TL324**
14:30	*Cao Shengming*	*Marco Bonfanti*	*Cui Shipeng*	Satellite room/ Private space
14:45	*Muhammad Labaran*	*Keely Shand*	*Rory Allanson*	
15:00	*Estefan Diaz Mercado*	*Lucas Nahas Martinez*	*Alexandra Michnowicz*	
15:15	*(Z) Ali Alsayegh*	*Lyne Mkoh*	*Esther Uwandu*	
15:30	Break			
Session 2				
	TL423	**TL325 a&b**	**TL329**	**TL324**
15:45	*Beatriz Donagueda*	*Amy Grech*	*Justine Dyikuk*	Satellite room/ Private space
16:00	*Andrew England*		*Gertrude Ugwu*	
16:15	*Farhana Binti Mohammed Isa*		*Ijeoma Akubue*	
16:30	Break			
16:45	Closing ceremony and Award Session for best poster and abstract (Room TL325a&b)			
17:00				

Reception (17:00-19:00) and Ceilidh Dance (19:00-close) (Student Union)

Presentation Titles

Oral Presentations

Solution for Sustainability			
Author	Title	Room No	Time
Ali Alsayegh	Industry 4.0: Enhancing the Performance of Energy Organizations through the Implementation of Knowledge Management and Advanced Technologies. *Abstract*	TL423 (Zoom)	Day 3-15:15
Andrew England	Gigacycle Fatigue Performance of Welded Steel Joints. *Abstract*	TL423	Day 3-16:00
Anna Gribbon	Improving Understanding of How the Presence of Algae in the Ocean Affects Light Transmission. *Abstract*	TL423	Day 1-11:15
Athanasios Karampourniotis	Assessing the Strength of Biomineral Strategies for Concrete Repairs. *Abstract*	TL423	Day 2-10:15
Beatriz Donagueda	Porous Metal-organic Cages Based on Rigid bicyclo[2.2.2]oct-7-ene type Ligands: Synthesis, Structure, and Gas Uptake Properties. *Abstract*	TL423	Day 3-15:45
Cao Shengming	Electricity Transmission Network Planning Under Uncertainty. *Abstract*	TL423	Day 3-14:30
Estefan Diaz Mercado	Fluid Structure Interaction Simulations of a Flexible Plate for Tidal Current Energy Harvesting with Smart Material. *Abstract*	TL423	Day 3-15:00
Ewan McRobert	A Systematic Review of the Applications of Non-Wearable Sensors to Automate Intensive Livestock Farming. *Abstract*	TL423	Day 1-14:00
Farhana Binti Mohammed Isa	Green Spaces' Efficacy of Outdoor Learning in a Preschool Environment: Case studies in Glasgow and Kuala Lumpur. *Abstract*	TL423	Day 3-16:15
Frank Ndiata	Digital Transformation of Manufacturing SMEs: An Adaptive Guideline for Implementing DT in SMEs. *Abstract*	TL423 (Zoom)	Day 1-14:30
Jonathan Conn	Improving Drug Discovery by Enhancing Solubility Prediction Using Machine Learning, *Abstract*	TL423	Day 1-11:00
Muhammad Labaran	Industry 4.0 Driven Green Supply Chain Management to Tackle Sustainability and Supply Chain Problems within the Renewable Energy Sector. *Abstract*	TL423	Day 3-14:45
Nagehan Kaya Balkaya	Design of Sustainable and Resilient Food Bank Supply Chain Network under Uncertainty. *Abstract*	TL423	Day 2-10:00
Oyedotun Oyewole	Design, Analysis, and the Control of a Multiport-Isolated Bidirectional DC-DC Converter for Hydrogen Storage Systems. *Abstract*	TL423	Day 2-10:30
Ross Urquhart	Prediction of Acid Dissociation Constant Values through use of a Machine Learning Potential. *Abstract*	TL423	Day 1-11:30
Shabadini Sampath	Intelligent and Robust Control of Space Manipulator for Active Removal of Space Debris. *Abstract*	TL423 (Zoom)	Day 1-10:45
Stuart Clark	Development of a High-pressure Vessel for Measurement and Validation of High Pressure and	TL423	Day 1-12:00

	Temperature Tuneable Diode Laser Spectroscopy for Advancement of Gas Turbine Engines. *Abstract*		
Ubong Essien	Development of a Novel Solid Oxide Cell Material for on-demand Production of Hydrogen and Electricity. *Abstract*	TL423	Day 1-11:45
Shahrzad Zeinali	An Innovative Urban Green-blue Infrastructure Framework for Implementing Nature-based Solutions in Cities. *Abstract*	TL423	Day 2-10:45
Chinyere Ekperechukwu	Unleashing the Potential of Renewable Energy with Engineered Materials for Solid Oxide Cell. *Abstract*	TL423	Day 1-16:00
Muftah Abu Obaida	Improved GPR and ERT Analysis for Crack Assessment in Concrete Structures. *Abstract*	TL423	Day 1-15:30
Hamish Swanson	Synthetic Supramolecular Springs – Energy Transduction in Chemical-fuelled Rotating Nanoribbons. *Abstract*	TL423	Day 1-15:15
Marianella Bolivar Carbonell	Technical Resource Assessment of Hybrid Wind Offshore – Tidal Stream Energy Systems. *Abstract*	TL423	Day 1-14:15
Susan Brush	Great Britain's Electricity System – The Right Rules for the Right Equipment? *Abstract*	TL423	Day 1-14:45
Frederick Ebili	Structural Analysis of Offshore Pipelines to Prevent Oil Spills and Gas Leaks. *Abstract*	TL423 (Zoom)	Day 1-15:45

Inclusive Communities and Policies

Author	Title	Room No	Time
Alexandra Michnowicz	Sustainable Urban Mobility: Inclusion of Marginalised Communities. *Abstract*	TL329	Day 3-15:00
Andrew Currie	Understanding the Cognitive Strengths of Adult Autistic Readers of Literary Narrative. *Abstract*	TL329	Day 1-12:00
Cui Shipeng	Inclusive Community and Immigrant Chinese Teachers' Identity in Scotland Chinese Schools. *Abstract*	TL329	Day 3-14:30
Erica Zuniga	Invisible Native Americans: Garifuna Communities in the Caribbean and around the World. *Abstract*	TL329	Day 1-14:30
Esther Uwandu	Gender and Feminism: An Interrogation of Migrant (Lived) Experiences in Contemporary African Feminist Novels. *Abstract*	TL329	Day 3-15:15
Feline Fehring	A Structured Wicked and Complex Problem-based Analysis Framework. *Abstract*	TL329	Day 1-11:00
Fitri Berutu	Managing Frontstage and Backstage Behaviour: Rituals and Sustainable Theatrical Performance in Ecotourism. *Abstract*	TL329	Day 1-11:45
Gertrude Ugwu	Information Seeking Behaviour of UK Retail Banking Consumers towards Online Purchase Adoption: An Integrated UTAUT2 Model. *Abstract*	TL329	Day 3-16:00
Ijeoma Akubue	Participatory Rights of Children in the Criminal Justice System of Scotland, United Kingdom and Lagos, Nigeria. *Abstract*	TL329	Day 3-16:15
Jois Stansfield	Desperately Seeking Men: The Case of Speech Therapy. *Abstract*	TL329	Day 1-14:00
Juraj Sikra	Improving Cybercrime Reporting in Scotland: The Victims' Perspective. *Abstract*	TL329 (Zoom)	Day 1-11:15

Justine Dyikuk	Boko Haram's Media Offensive and Government's Counterinsurgency Efforts: Towards Strategic Communication Solution. *Abstract*	TL329	Day 3-15:45
Mengyi Mei	Strengthening the Liability for Online Copyright Infringement of Short Videos on Short Video Platforms. *Abstract*	TL329	Day 1-10:45
Phindu Lipenga	Factors that Affect Mobile Money Adoption in Sub-Saharan Africa. *Abstract*	TL329	Day 2-10:00
Rory Allanson	Evaluating the Impact of Paid Family Leave Policies on Abortion Rates: Evidence from Five U.S. States. *Abstract*	TL329	Day 3-14:45
Sonya Fonweban	Urban Planning, Policy, and Technology; Urban District, City Building. *Abstract*	TL329	Day 1-11:30
Stuart Bagnall	The Correlates of Land Reform Dataset. *Abstract*	TL329	Day 1-14:15
Bryan Yan Wang	Enhance LGBT Protection through UK Corporate Governance. *Abstract*	TL329	Day 2-10:15
Karyn Mabon	The Role of 'Resilience' in the Lives of Justice Experienced Women Living in the Community in Scotland. *Abstract*	TL329	Day 1-14:45
Nitiwate Meesonk	Long-term Care for the Elderly in East Asia After Confucianism: A Comparison of Japan, Singapore, and Thailand. *Abstract*	TL329 (Zoom)	Day 1-15:15
Ridvan Ayhan	The Clash of Ethics and Economics in Inclusive Education. Abstract	TL329	Day 2-10:30
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Author	Title	Room No	Time
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Bohdana Schwendtner	Entrepreneurial Ecosystem: Knowledge Creation, Sharing and Learning. *Abstract*	TL325	Day 1-14:15
Donna Meadows	A Novel and Practical Care Process Framework to Inform Model of Care Development. *Abstract*	TL325 (Zoom)	Day 1-14:45
Saba Aslam	The Impact of Stock Market Crises on Local and Global Safe Haven Assets; Evidence from Global Financial Crises (GFC) 2008, COVID-19 Pandemic and Russia and Ukraine Conflict 2022. *Abstract*	TL325	Day 1-14:30
Jai Geelal	A Framework for Building Superior Portfolios Using Topological Data Analysis and Hierarchical Risk Parity. *Abstract*	TL325	Day 1-15:15
Wafa Alwafi	Does Variance Risk Premium Predict Bitcoin Return? *Abstract*	TL325 (Zoom)	Day 1-15:45
Harry Patria	Understanding the Impact of Cognitive Styles on Scenario Planning. *Abstract*	TL325	Day 1-15:30
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Andrew Porter	NoFap Communities and Desires of Disconnection. *Abstract*	TL325	Day 2-10:45
Brenda Morrison	Prescribing for Older People with Sensory Impairment: A Study with Independent Prescribers in Primary Care. *Abstract*	TL325 (Zoom)	Day 1-11:15
Callum Davidson	Next Generation Lipid Nanoparticle Therapeutic Stability Evaluation. *Abstract*	TL325	Day 2-11:00
Eugene Asante	User-centred Design of Digital Products and Services for Supporting Older Adults with Sensory Impairment in their Medicine Management. *Abstract*	TL325	Day 1-10:45
Issah Imoro	Sustainable Scheme for Children's Access to Corrective Spectacles in Ghana. *Abstract*	TL325	Day 1-12:00
Karim Osouli Bostanabad	Electroactive Materials for Nervous Systems Regeneration by 3D/4D Printing. *Abstract*	TL325 (Zoom)	Day 1-11:30
Keely Shand	Monte-Carlo Simulation of Infant Visual Acuity Testing. *Abstract*	TL325	Day 3-14:45
Kullapat Chaiyawat	Eye Drops Design for Older People with Sensory Impairment. *Abstract*	TL325	Day 2-10:00
Liam Moorhouse	Your Well Being is for Sale: The Commercialisation of Biometric and Health Data. *Abstract*	TL325	Day 1-11:45
Lucas Nahas Martinez	Effect of Fluid Shear on The Polymorphism of Seeded Crystallizations. *Abstract*	TL325	Day 3-15:00
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Marco Bonfanti	Exploring Protease Signalling within the Cell Utilising Super Resolution Microscopy. *Abstract*	TL325	Day 3-14:30
Nura Umar	Optimal Parameter Choice for Imputing Missing Values in Water Level Data Using the K-Nearest Neighbour (Knn) Method. *Abstract*	TL325	Day 1-11:00
Samuel Etopidiok	Cultural Identity Preservation in a Modernizing Society: A Theoretical Framework for Safeguarding the Cultural and Architectural Identity of Heritage Buildings in the South-south Region of Nigeria. *Abstract*	TL325	Day 2-10:15
Suleyman Kahraman	Exploring the Characterisation and Sub-classification of Ataxic Dysarthria. *Abstract*	TL325	Day 2-10:30
Amy Grech	Designer Empathy in Virtual Reality: Transforming the Designer Experience Closer to the User. Abstract	TL325	Day 3-15:45

Poster Presentations

Solution for Sustainability	
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Jayson Cheyne	An Investigation into the Application of Flame-Retardant Phase Change Materials for Electric Vehicle Battery Thermal Management. *Abstract*

Jose Vindel Garduno	Risk Averse Model for Sustainable Bioproducts Overproduction. *Abstract*
Junyi Lu	A Path to Sustainable Energy Solutions in Neighbourhoods: Predicting System State for the Last Mile of Power Distribution Networks. *Abstract*
Mark Higgins	Integrated Systems Design of Composite Casings for Power Electronic Converters. *Abstract*
Meiling Jiang	An Overview of Path Planning for Autonomous Robots in Smart Manufacturing. *Abstract*
Muhammad Osama	Failure Modes of Carbon Fibre Reinforced Polymer: A Review. *Abstract*
Salah Kashlot	Exploring the Influence of Digital Fatigue in Instruction Post-Covid-19 Era on Higher Education Students' Performance: An Overload Perspective. *Abstract*
Samuele Martinelli	Towards a 3D Printed Acoustic Sensor Inspired by Hair-Like Structures of Insects: A Study of Hair Shape and Size. *Abstract*
Seehan Rahman	Improving the Resilience of Wastewater Treatment Plant. *Abstract*
Yaozhong Zhang	Development of guidelines for improving quality of life in Chinese old neighbourhoods through socio-cultural strategies: the study of a case of Chengdu Ma'an neighbourhood, China. *Abstract*
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Inclusive Communities and Policies

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Impactful Entrepreneurship and Innovation

Author	Title
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Healthier Humanity

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Benjamin Mitchell	Computational Analysis of Antibacterial Interactions in Lipid-Based Nanoparticles. *Abstract*
Ivan Yankov	Software to aid in DNA-Ligand Structure Determination Using Solution NMR and Restrained Molecular Dynamics Simulations. *Abstract*
Juliane Loges	Development of an Organ-on-a-Chip model of human vascular aging. *Abstract*
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Parastoo Zali	Architectural Provisions Supporting the Safe Navigation of Older People with Sensory Impairment (Opwsi): A Scoping Review. *Abstract*
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Sara Scarfo	Neuropsychiatric Clusters of Symptoms in Alzheimer's Disease and Mild Cognitive Impairment Over Time. *Abstract*
Sarah Eccles	Development and Characterisation of Antibacterial Coatings for Orthopaedic Implants. *Abstract*
Stephanie Mccrory	Adapting a Sleep Intervention for Adolescents with Co-Morbid Mental Health Problems: A Delphi Study. *Abstract*
Zainab Alsiryawi	Design of "Seek-and-Destroy" Nanosized Particles for the Treatment of Prostate Cancer Cells. *Abstract*
Zoe McKinnon	Particle Size and Viscosity Analysis of Fasted State Simulated Intestinal Fluid Reflective of In-Vivo Gastrointestinal Variability. *Abstract*

ABSTRACTS

Oral Presentations

Solutions For Sustainability

Industry 4.0: Enhancing the Performance of Energy Organizations through the Implementation of Knowledge Management and Advanced Technologies

Ali Alsayegh [a], *Tariq Masood* [b]

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Keywords: *Industry 4.0, Knowledge management, Energy organizations, Performance enhancement, Operational efficiency, Sustainable growth*

Industry 4.0 (I4) technologies, such as digitalisation, automation, IoT, and AI, are significantly transforming various sectors, including energy organizations [1]. Knowledge management (KM), defined as the process of creating, sharing, using, and managing knowledge within an organization, is critical in enhancing the performance of energy organizations by facilitating efficient decision-making, fostering innovation, and supporting sustainable growth [2,3]. The primary objective of this research is to investigate the implementation of KM in energy organizations and evaluate its impact on their performance within the I4 era. The guiding research question is: "How can KM be effectively integrated to enhance the performance of energy organizations in the era of I4?".

This study employs a mixed-methods approach, combining a structured literature review, industry surveys, expert interviews, and case studies. The anticipated outcome is the development of a comprehensive framework for implementing KM in energy organizations. The framework will aim to: (i) improve operational efficiency; (ii) reduce costs; (iii) foster a culture of innovation to adapt to changing market conditions; and (iv) promote sustainable growth and resource management. Validation of the framework will be conducted through surveys and interviews with employees and stakeholders, performance metrics related to innovation and sustainability, industry comparisons, and feedback on the company's sustainability efforts.

As the research progresses, several key areas will be further investigated to better understand the nuances of KM implementation in energy organizations within the I4 context. These areas include:

1. Engineering processes: Investigating how KM can be integrated into engineering processes, such as design, production, and maintenance, to improve the efficiency of energy organizations in the I4 era [3].

2. Technological integration: Assessing the role of advanced technologies, such as IoT, AI, big data analytics, and cloud computing, in facilitating KM processes within energy organizations [4]. This includes investigating challenges and

opportunities associated with technology adoption and its impact on decision-making, predictive maintenance, and real-time data analysis.

3. Skills development: Analysing the development of a skilled workforce possessing the necessary technical and managerial competencies for implementing KM strategies in the I4 era [5]. This encompasses evaluating ongoing training, cross-functional teams, and employee involvement in the KM process.

4. Performance measurement: Identifying key performance indicators (KPIs) to evaluate the success of KM implementation in energy organizations, focusing on operational efficiency, innovation, and sustainability [6].

5. Best practices and case studies: Examining real-world examples of successful KM implementation in energy organizations operating within the I4 context [7]. This will provide valuable insights and lessons learned from I4, informing the development of a comprehensive KM framework for energy organizations that leverages cutting-edge digital technologies and data-driven approaches.

The main academic contributions of this research are expected to be the development of a KM framework tailored to energy organizations operating within the I4 context and insights into KM's role in enhancing organizational performance and sustainability. The industrial impact is anticipated through improved performance of energy organizations, leading to increased competitiveness and long-term sustainability. The significance of this topic lies in its potential to contribute to the ongoing energy transition by promoting efficient and sustainable energy production and consumption. Implementing effective KM strategies enables energy organizations to optimize their operations, reduce costs, and foster innovation. The findings of this study are expected to have a substantial impact on the energy sector, the global economy, and society at large.

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Gigacycle Fatigue Performance of Welded Steel Joints

Andrew England [a]*, *Athanasios Toumpis* [a], *Yevgen Gorash* [a]

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Keywords: *Gigacycle fatigue, Welded joint, Structural steel, Ultrasonic fatigue testing, Materials engineering*

The strength under repeated loading, known as fatigue strength, is an important factor when designing a steel component or structure. Over many stress cycles, small cracks initiate and subsequently propagate through the material, leading to failure. In engineering standards and textbooks it is often assumed that steel has a “fatigue limit”, i.e. a stress range at which cracks will not propagate and fatigue failure will not occur. In the last 20 years it has been established that this assumption is not valid, with fatigue failures occurring at lower stresses than proposed fatigue limits in steel base material and welded joints. The process of welding creates features that reduce the fatigue strength of a component and therefore welded joints are of great importance when assessing structural integrity.

This research aims to improve the scientific understanding of the topic of the gigacycle (beyond 1 billion stress cycles) fatigue of welded joints. The main application of this research is advancing the technology and design of existing and new processing equipment used in the mining industry. Extracting minerals from the earth is a necessary step towards achieving net-zero, since the production of certain technologies like solar panels and electric cars relies on these materials. To separate and size mineral ores, vibrating machines are continually operated at high frequencies, resulting in billions of stress cycles being experienced in welded joints during the operating life. Due to a lack of experimental data and standards, the joints in vibrating machines are likely overdesigned. Therefore, a greater understanding of the fatigue performance in the gigacycle range will allow for improved design of welded joints, leading to machines that are more sustainable to manufacture and operate.

Completing gigacycle fatigue tests within a practical and economical timeframe has only recently become feasible due to the introduction of ultrasonic frequency testing machines. The Advanced Materials Research Laboratory in the Department of Mechanical and Aerospace Engineering hosts a USF-2000A fatigue testing machine, capable of operating at a testing frequency of 20kHz. The test specimens are excited at their natural frequency, meaning that fatigue tests can be conducted up to 1000 times faster than using standard fatigue testing machines.

This research involved the design of a specimen which captures the weld toe and root features which are most susceptible to fatigue failure, as an alternative to conventionally used hourglass shaped specimens. Welds were conducted in-house using S275 structural steel and flux-core arc welding, materials which are commonly used in the mining industry. Specimens were tested at varying stress amplitudes until they either reached failure or had undergone 10 billion stress cycles. This allowed for the generation of a novel S-N curve, an empirical model that is used in engineering design to predict the fatigue life of a component.

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Improving Understanding of How the Presence of Algae in the Ocean Affects Light Transmission

Anna Gribbon, David McKee, Paul Griffin

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Keywords: *light transmission, scattering, phytoplankton, ocean optics, climate change*

Types of algae, like phytoplankton, in the ocean play a significant role both in the global carbon cycle, by acting as a large consumer of CO_2, and in ecosystem dynamics as part of the food chain. Monitoring phytoplankton cycles over long time periods allows researchers to assess changes in carbon storage capacity, alongside assessing how the health of the ecosystem is being affected by our changing climate. The movement of light through ocean waters is affected by phytoplankton. Optical monitoring of the presence of phytoplankton can be performed by recording how much light is transmitted through a given area, which changes if light has been absorbed or scattered at large angles.

Standard instruments for measuring beam transmission record the proportion of light transmitted through a sample compared to that transmitted through pure water. The transmitted light is focused down through a small aperture to exclude as much scattered light as possible from the detector. However, standard techniques for measuring beam transmission cannot distinguish perfectly transmitted light from light scattered in the forward direction and captured within the collection angle of the detector *(McKee et al., 2013)*. The associated errors vary with particle size and the collection angle of the detector. An emerging area of research in this field examines how scattering of a light beam from particles changes the behaviour of the beam. Scattering events can cause spatial incoherence, meaning that the information carried by the light becomes scrambled in space. There is increasing interest in how the resulting spatial incoherence can be used to identify the amount of scattering that has taken place and exploit this to find a clean transmission signal (*Alley et al., 2018*).

We have produced and optimized a system that can remove forward-scattered light from transmission measurements by separating the incoherent light caused by scattering from the transmitted light that remains coherent. The light transmission measured using this novel coherence-based technique have been compared to those measured using a standard technique. The coherence-based method consistently records lower transmission through different sample types compared to the measurements made using the standard method, suggesting the correction of the systematic bias caused by measuring scattered light. This effect potentially increases with increasing particle size, matching expectations from theory. Looking forward, the performance of this novel technique will be mapped out for a range of particle sizes and sample types, alongside further calibration of the system. This work paves the way for a new type of sensor that can more accurately monitor light transmission in the ocean and improve climate monitoring.

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Room No: TL423, Wednesday 14th of June, 11:15

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Assessing the Strength of Biomineral Strategies for Concrete Repairs

Athanasios Karampourniotis, Dr. Gloria Castro Quintero [a], Prof. Rebecca Lunn [b], Dr. Enrico Tubaldi [c], Dr. Grainne El Mountassir [d]

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Keywords: *sustainability, MICP, biotechnology, concrete, FEM*

Worldwide production of concrete is estimated to be responsible for approximately 8.6% of all CO_2 emissions originating from human activity. Many countries, including the UK, now have ambitious targets to achieve net zero greenhouse gas emissions. In order to achieve these targets, the construction industry needs to transform its use of materials and approaches to asset management, with a shift towards extending the lifespan of existing structures, rather than constructing new ones.

Microbially Induced Carbonate Precipitation (MICP) is a sustainable and novel process in which ureolytically active bacteria trigger the catalysis of urea, resulting in the formation of calcium carbonate crystals. MICP shows promise for a wide range of engineering applications including rock fracture grouting, soil strengthening and stone and concrete repair.

The aim of this research is to develop a mesoscale Finite Elements Model (FEM) to predict the mechanical behaviour of MICP-treated concrete. In order to calibrate the FEM model, MICP treatment and tensile strength tests were conducted on concrete cores. Ten cylindrical concrete specimens were drilled from a caisson acquired from docks in Devonport, England. Subsequently, the cores were artificially cut along their vertical length creating a single fracture within each core. A variety of filling scenarios were investigated: (i) open fracture with glass bead spacers (500μm in diameter) only present at corners, (ii) patches of glass beads within the centre of the fracture, (iii) fully packed with glass beads, (iv) fully packed with silica sand grains, and (v) fully packed with carbonate sands.

Cores were subjected to multiple treatments of MICP. Each treatment included the injection of *Sporosarcina Pasteurii* (highly ureolytically active bacteria) followed by injections of a cementing solution consisting of calcium chloride and urea. Core permeability was monitored after each treatment cycle. Treatment was stopped once a 2-order of magnitude reduction in permeability was observed. After treatment, the cores were subjected to X-ray Computed Tomography (XCT). Scanning and image analysis was conducted to evaluate the amount and spatial distribution of contact points created by calcium carbonate precipitation bridging across fracture surfaces. Following XCT imaging the cores were loaded under Brazilian test conditions to evaluate tensile strength. After failure, the patterns of calcium carbonate precipitation

on the surfaces of the fracture were inspected, validating the results derived from image analysis.

The experimental results show that the mechanical strength of the MICP-treated cores is governed by the amount of calcium carbonate precipitation which bridges across from one fracture surface to the other. A FE model simulating tensile loading has been developed which can be used to predict the mechanical behaviour of MICP-treated concrete as well as to better understand the influence of MICP treatment strategies on mechanical strength recovery and help progress from controlled lab-scale conditions to implementing this process efficiently in field-scale structures.

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Porous Metal-organic Cages Based on Rigid bicyclo[2.2.2]oct-7-ene Type Ligands: Synthesis, Structure, and Gas Uptake Properties

Beatriz Doñagueda Suso [a], Alexandre Legrand [b,c], Catherine Weetman [a], Alan R. Kennedy [a], Ashleigh Fletcher [d], Shuhei Furukawa [b,e], Gavin A. Craig [a].

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Keywords: Porous materials, Metal organic cages, Gas sorption, Supramolecular chemistry, Gas capture

Climate change is mainly produced due to the release of greenhouse gases like carbon dioxide or methane to the atmosphere. Making materials that can capture efficiently these gases is challenging. Extensive research has been conducted on various types of porous materials. Among all of these materials, a particular type are Metal-organic Polyhedra (MOPs). These porous materials have a cage shape making them suitable to uptake gas in their structure. They are formed by metal ions and organic linkers behaving like isolated molecules. This molecular behaviour favours their solubility in common solvents.[1] Herein, we describe a new family of MOPs formed by four copper metal ions and four organic molecules with formula $[M_4L_4]$, known as lantern-type.[2] The core of the organic molecule used for the construction of the cages (3,3'-(1,3,5,7-tetraoxo-3a,4,4a,5,7,7a,8,8a-octahydro-4,8-ethenopyrrolo[3,4-f]isoindole-2,6(1H,3H)-diyl)dibenzoic acid) is the same,[3] but for each of them a different functional group has been added: CH_3O- for **1-DMA**, CH_3- for **2-DMA** and Br- for **3-DMA**. Due to these chemical changes in the composition of the organic molecule, the size of the cages are completely different, from elongated cages to distorted ones. This difference in the shape of the cage can change their uptake capacity for different gases. To analyse their gas uptake performance, two different gases have been tried, CO_2 at 195 K (-78.15 °C) and N_2 at 77 K (-196°C). For this, the cages were exposed to different pressures of the gas in the range of 0-1000 mbar, recording the amount captured by the cage at that pressure (Figure 1). While the three different cages capture CO_2, only **2-DMA** adsorpt N_2, allowing us to calculate the BET surface area of the cage, being the highest BET surface area reported for lantern-type MOPs with a value of 521 m^2/g.

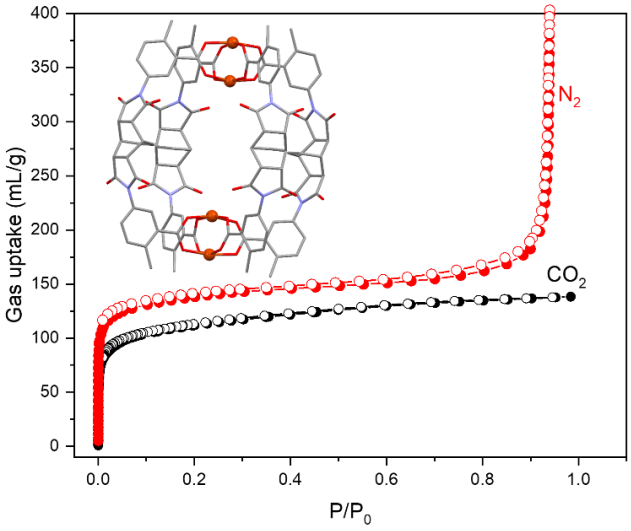

***Figure 1**.N_2 uptake (red) and CO_2 uptake (black) for one of the cages. Inset: Structure of one of the cages*

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Electricity Transmission Network Planning under Uncertainty

Shengming Cao, Waqquas Bukhsh [a].

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Keywords: *Stochastic Optimization, Power System, Transmission Network, Uncertainty, Renewable Energy*

The transmission of electricity is highly depending on the transmission network. As society develops, the demand of electricity is increasing as household heating and electrification of transport sectors rely on it. In this circumstance, more new transmission networks are in need of construction (Alassi et al,2019). However, the distance of the transmission network, the voltage level and other factors affect the loss of electricity in the transmission and the cost of investment for the power system (Zhu et al, 2022). Therefore, a well-designed and efficient transmission network will significantly reducing the operating cost.

With the introduction of carbon neutrality targets, the share of renewable energy in the power system has increased rapidly in recent years (Li et al, 2022). Renewable energy now accounts for 43.1% of the UK's electricity generation (Sajjadian, 2023). However, renewable energy is highly uncertain and can be susceptible to sudden drops in generation capacity or even shutdowns due to extreme weather conditions (Meenal et al, 2022). On the other hand, the uncertainty of customer-side electricity consumption also poses a challenge for the electricity system.

Generally, renewable energy plants are located in remote areas in order to obtain maximum efficiency in the generation of electricity and the development of renewable energy. such as offshore wind projects, which 14 GW offshore wind turbine currently operating in the UK (UKWED, 2023). However, it means that users are further away from the power station and therefore require longer transmission lines than conventional thermal power plants. In recent years, a number of researches suggested that transmission lines may have a negative impact among the lives of people living along them (Cotton & Devine-Wright, P, 2013) and also affects the ecological environment (Costantini et al, 2017). It is therefore crucial to plan the transmission lines, find the balance between cost, environmental impact and transmission stability, in order to keep the power system work more effectively.

Therefore, this study aims to construct a deterministic formulation based on data as a basis for improving the model from the Network Options Assessment (NOA) report of National Grid ESO (National Grid, 2022) with the objective of maximum economic efficiency/minimum environmental impact. On the basis of this formulation, the introduction of renewable energy uncertainty and build a mathematical model for computer simulation using Python and the models are build using PYOMO, which is an Algebraic Modelling Language developed in Python programming language. Gurobi is used as a solver for models.

In terms of model design. This study aims to construct the objective function with the indicators of maximum economic efficiency/minimum environmental impact (lowest CO2 emissions)/highest transmission efficiency (minimum transmission losses). Line costs, line losses, customer energy consumption fluctuations, power flow models, power network operation data and meteorological data are used as the basis

variables. The mathematical model is constructed by combining the operational performance of various types of power generation and transmission and conversion equipment. The above data and models are used to construct a computer simulation program using python. The first step is to analyse historical data on the uncertain variables (meteorological data, customer electricity consumption habits) that appear in the model to derive a power system planning and dispatching scheme for the deterministic optimisation case. The second step is to introduce robust or stochastic optimisation, which introduces the volatility of the uncertain variables, and thus derives the optimisation model and results under uncertainty.

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Fluid Structure Interaction Simulations of a Flexible Plate for Tidal Current Energy Harvesting with Smart Material

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Keywords: *CFD, FSI, Open-Source coding, Marine Energy, Numerical Analysis*

By utilising a more holistic and ground up approach to the development of a tidal energy device, this research is seeking solutions to the ever-present need for clean and reliable electricity generating systems. With a continually growing interest in marine renewables as more ways to harness energy from that environment are being investigated, special attention is being paid to flexible energy converters. The study of these requires multidisciplinary contributions from the fields of marine, mechanical, and electrical engineering as well as computer science and marine ecology. Traditional Power Take Off (PTO) devices limit the water motion that can be harnessed with their rigid motion capabilities. Therefore, different PTO solutions are being investigated that can harness more oceanic phenomenon. While there are several ways to harness energy from the ocean, this study focuses on tidal currents. More specifically, relatively low velocity currents of lower than 2.5 m/s that are more common around the world [1]. The use of flexible, and often deforming, slender bodies has proven promising due to their ability to be constructed of smart material. In the case of power generation, the smart material consists of nanogenerators. The two main types of nanogenerators, piezoelectric and triboelectric, together have three motion driven working modes that convert kinetic energy into electrical energy [2]. Understanding the interaction between a structure and the fluid environment requires the combination of computational fluid dynamics (CFD) and structural mechanics (CSM) in a single coupled simulation run [3]. The governing equations of mechanics and conservation laws are solved in tandem in order to scientifically describe the interaction. The current work features fully modifiable simulations of a flat, thin plate perpendicular to the flow with three opensource software: PreCICE, OpenFoam, and CalculiX. These programs individually solve the CFD and CSM of the simulation and are coupled with PreCICE which creates an information sequence between OpenFoam and CalculiX. The fluid structure interaction (FSI) of the flexible device with the current can point on how to best arrange multiple plates within the domain. In addition, the FSI information from simulation runs can be supplied to a numerical analysis code to estimate power generation from the deformations of the device [4]. Research of this topic could result in useful findings that positively impact the possibility of implementing nature-derived energy system designs into the grid.

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A Systematic Review of the Applications of Non-Wearable Sensors to Automate Intensive Livestock Farming

Ewan McRobert

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Keywords: *Precision Livestock Farming, remote sensing, machine learning, computer vision, agriculture*

Background: Due to competition and economies of scale, livestock farms are growing in size. Traditional approaches to livestock farming rely upon the farmer's observations of animal behaviour to identify animal welfare issues and make appropriate animal management decisions. However, this approach is no longer practical given the sheer number of animals in their care. In response to this the field of precision livestock farming (PLF) has emerged.

PLF is the adaptation of the principles of process engineering to livestock management, where sensors are used to continuously monitor animals and this data is processed by machine learning models which help farmers make optimal decisions at the level of individual animals. The most commonly adopted sensors are wearable sensors such as accelerometers which track animal movement.

However, there are multiple downsides to wearable sensors. The rough farm environment means they are often damaged. Moreover, fitting them to each animal and replacing batteries when necessary is labour intensive and can be stressful for both the farmer and animal. Furthermore, they can cause animal discomfort and even alter animal behaviour. It is also an expensive solution to the problem requiring a costly sensor for every animal. This is not affordable for farms in developing countries or for poultry farms where the cost of the sensor is disproportionate to the value of the animal.

A developing area of research is to use remote sensors such as video cameras, microphones and infrared cameras to monitor animals. As one sensor can monitor multiple animals this approach is both more economical and scalable.

Aims: The objective of this review is to evaluate the scope of existing research on the use of non-wearable sensors to aid livestock farming and to identify what future work is required. To meet this objective the following research questions were selected:

Q1. Which non-wearable sensors are used for intensive PLF?

Q2. What problems are non-wearable sensors being used to solve?

Q3. How do datasets compare between studies?

Q4. Which machine learning models are used to interpret the data produced by non-wearable sensors?

Q5. What information is used as the ground truth when evaluating models?

Q6. What are the challenges faced and limitations of existing work?

Method: Initial search terms and synonyms were identified by studying similar reviews and were expanded upon through an iterative process of searching, analysing results then revising the search terms to include any new synonyms identified. As the review is multidisciplinary covering animal science, engineering (sensors) and computer science (the machine learning models to process the sensor data) the following relevant databases were searched: Agricultural Environmental Science Database; Compendex; Scopus and Web of Science (core collection).

Impact: The livestock sector is responsible for 14.5% of greenhouse gas emissions(HLPE, 2016). Growing populations in the developing world coupled with urbanisation and increased incomes means there is an increasing demand for meat and dairy. It has been projected that global demand for animal calories will have doubled by 2050(Gouel & Guimbard, 2019). Therefore, to be able to feed future populations in a sustainable manner it is vital to identify affordable technology which makes livestock farming more efficient and works at the scale of the largest farms.

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Green Spaces' Efficacy of Outdoor Learning in a Preschool Environment: Case Studies in Glasgow and Kuala Lumpur

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Keywords: *Outdoor learning, preschool environment, green space, learn-through-play, LTP*

Urbanization and industrialization should not limit preschool children to obtain benefits from green space and outdoor learning. It is a challenge for architects to ensure that every school has a green space that is sensibly planned and designed for the benefit of school users. The educators also have to play roles to maximize the usage of green spaces in line with the syllabus of learning and activities rather than focusing on indoor learning and classroom methods. This method only uses visualization rather than experiencing it first-hand.

Due to green space scarcity in urban preschools, there is a big gap in child's connection and exposure to the natural environment. These have impacted the children's crucial developmental stages for physical, emotional, and intellectual development. Children learn and focus more through play (learn-through-play, L-T-P). By exploring the different typologies of structured play in a preschool outdoor environment, children will develop their sense of mind and qualities in thinking. The importance of outdoor learning spaces has benefitted widely in secondary to higher education. However, to date, little research has explored the outdoor learning environment to the extent of preschool settings focusing on children between 3 to 6 years old.

Comparative studies will be conducted in three (3) Public Nursery Schools in Glasgow and Kuala Lumpur, to rationalize the relationship between the availability of green spaces and outdoor learning environments in urban areas. In order to measure the value of green spaces in a preschool environment, a mixed-method research strategy with a quantitative method as the main approach supplemented by qualitative methods will be conducted. This study will begin with selecting a few case studies of outdoor preschool environments as a basis for developing a questionnaire survey and observation checklist. The observation methodology uses a combination of space/nature syntax and a child-nature-distance (C-N-D) approach to evaluate the children's movement and space utilization. This method aims to enhance the value of green spaces in preschool environments to reconnect children back to nature.

Secondly, surveys and questionnaires will be conducted to gather priorities and attributes from teachers and school owners on the issues and barriers to implementing outdoor learning. This method aims to gather information in assisting educators to implement L-T-P in outdoor environments and further aligned with preschool curriculum activities. The outcome shall minimize children's social problems such as delays in speech, slow movement, and poor cognitive learning. Lastly, recommendations and solutions will be gathered from Architect's perspectives through conducting expert interviews. The findings on design strategies in maximizing green

spaces for preschool outdoor environments will conclude as a design framework strategy.

The value of this research lies in identifying the Architect design attributes that are of the greatest importance to the preschool environment. Such findings could help policymakers and architects to provide better design solutions in the allocation of green spaces in a preschool environment.

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Digital Transformation of Manufacturing SMEs: An Adaptive Guideline for Implementing DT in SMEs

Frank Ndiata[1], Tariq Masood[2]

Keywords: Digital Transformation, SMEs

Digital Transformation (DT) has become one of the key strategies to ensure business development and sustainability [1]. The use of DT through smart technologies such as the Internet of Things (IoT), Artificial Intelligence (AI) and Cloud Computing (CC) [2] provides opportunities for value creation, changes relationships with customers and core processes, and improves operational efficiency [2]. The transition to DT provides opportunities for survival and competitiveness in the form of manufacturing productivity, reduced operating costs, improved product quality and novelty [2]. DT also allows companies to respond to the current market development characterized by the need for digital and personalized products [1].

As the calls for business transformation continue to resonate, businesses around the world have launched projects to discover and exploit the benefits this trend brings to businesses. However, closer examination shows that most of them have not yet produced satisfactory results [5]. In the case of manufacturing SMEs, failure is due to multiple reasons. In addition to their complexity [2], the skills and expertise needed to manage it, the DT project requires a resilient infrastructure, excellent technological capabilities, and increased access to data. Thus, to benefit from this trend, SMEs are forced to invest heavily in advanced technologies, experiment with new options and modify their business model [4]

To thrive and survive in today's business atmosphere characterized by the advent of new technologies, the need for digital products, and the use of social media to purchase products by consumers, the transition to DT has become a norm [2]. Unfortunately, due to significant environmental constraints, this transition has not yet fully begun for many SMEs [5]. Yet despite the role these companies play in the global economy and the sustainability benefits associated with DT, SMEs are at a disadvantage when it comes to initiating a full DT process. Thus, SMEs need support in the form of guidelines to enable them to develop a suitable roadmap for the implementation of DT. However, the current body of knowledge in this field is considered fragmented and lacks relevant information on the environment in which SMEs operate and the need for adaptive guidelines [2]. Moreover, DT remains one of the most misunderstood and misused concepts in literature, leading to misapplication and failure of digital projects [6]. Yet, without a solid understanding of what DT means and the vision behind it, the likelihood of failure is higher.

This study fills this gap by developing an adaptive guideline that explains diverse aspects of DT and how SMEs can effectively implement the DT process.

However, the overall aim is to answer the following research question: “What factors play a significant role in successful digital transformation of manufacturing SMEs?”

To answer this question, a mixed research methodology will be followed involving a qualitative review of the DT literature to determine:

1. the essence of DT,

2. the vision behind it and,

3. the key success factors for the implementation of DT in manufacturing SMEs.

This will be followed by empirical case studies and analysis of industry DT projects and what contributed to their success to help develop guidelines for manufacturing SMEs.

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Improving Drug Discovery by Enhancing Solubility Prediction Using Machine Learning

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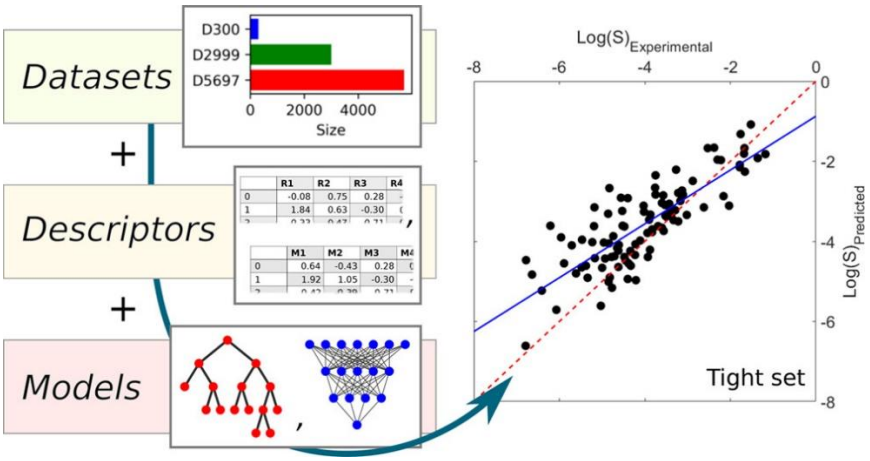
Keywords: *Solubility, Property prediction, Machine learning, Computational chemistry, Artificial intelligence*

Understanding the properties and behaviours of drug-like compounds is of paramount importance in drug discovery. Solubility is one of the most important properties to consider in drug candidates [1, 2]. It is defined as the maximum concentration of a solute in solution at thermodynamic equilibrium at a given temperature, i.e., it describes the ability of a solid compound to dissolve in a particular liquid. Poor solubility has been attributed to the failure of many otherwise promising drug candidates. Historically, solubility has been measured experimentally, but this demands a lot of time, money, and resources, especially on the scale of modern drug discovery.

More recently, computational methods have been utilised in the prediction of solubility, from data-driven statistical models [3] to artificial intelligence [4-6]. In this work, several machine learning models were developed for the prediction of intrinsic aqueous solubility of drug-like molecules. Machine learning is a form of artificial intelligence which is rapidly becoming integral to human advancement. Using machine learning, it is possible to analyse complex mappings between inputs and outputs involving huge amounts of data - far more than the human brain is capable of processing.



In 2008 [7], and again in 2019 [8], solubility challenges were issued to the global chemistry community in which participants would predict intrinsic aqueous solubility using machine learning. We submitted two models to the 2019 challenge, one of which placed within the top 10 submissions. A further six models were developed post-challenge to improve upon the performance of this model. This work was recently published [9], with an in-depth quantitative analysis highlighting the importance of both the volume of data used in model training and the reliability of that data.

By utilising computational methods, a more sustainable approach to drug discovery is possible. One of the first stages of the drug discovery process is to identify suitable drug candidates. Traditionally, this involves experimental measurement of key properties (such as solubility) of hundreds of thousands, if not millions, of compounds. Clearly, this approach requires an immense amount of time, money, and chemical resources. By employing computational models that can accurately predict these key properties, poor candidates can be rapidly identified and eliminated. This reduces the number of drug candidates that are taken forward for physical experimentation, increasing both the efficiency and sustainability of drug discovery.

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Industry 4.0 Driven Green Supply Chain Management to Tackle Sustainability and Supply Chain Problems within the Renewable Energy Sector

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Keywords: *Industry 4.0, Green supply chain management, Sustainability, Renewable energy*

There has been a considerable attention in recent years towards environmental concerns from both the academia and industry [1]. These concerns have given birth to pressures emanating from the global competitive markets, while environmental regulations as well as customers are forcing firms worldwide to thoroughly think about the environmental footprints arising from their business operations. Therefore, industries have since embarked on a journey to reduce their environmental impacts through the adoption of newer business and management paradigms instead of their traditional practices [2].

Green Supply Chain Management (GSCM) is one of the management paradigms that incorporate “green” philosophy in manufacturing, distribution, procurement and logistics [3]. GSCM involves a set of managerial activities that firms adapt to reduce pollution and energy consumption in an effort to attain sustainability. Also, the development and adoption of digital technologies have since become a trendy area of discussion with the Industry 4.0 (or the fourth industrial revolution) facilitating digital transformation in different facets of industry, and this is continuously gaining attention from industrialists and governments [4].

Industry 4.0 driven GSCM otherwise termed as digitally-enabled GSCM operates through new technologies and digital platforms [5]. Embedding Industry 4.0 technologies into GSCM and manufacturing operations can bring about visibility and enable a more efficient tracking of processes and materials across supply chains among many other benefits [6].

The aim of this research is to examine the adoption of Industry 4.0 driven GSCM to tackle sustainability and supply chain issues within the renewable energy sector. The study outlines some specific objectives in order to achieve the aim; these include conducting a systematic literature review on the current state of the art practices in the literature on GSCM, Industry 4.0, renewable energy and industry 4.0 driven GSCM. Other objectives include critically examining the role of industry 4.0 technologies in the adoption of GSCM practices, evaluating sustainability and supply chain related problems within the renewable energy sector and developing an Industry 4.0 driven GSCM framework to tackle sustainability and supply chain related issues within the renewable energy sector.

To fulfil the objectives set for this study, a triangulation research methodology is chosen, where both quantitative and qualitative methods of data gathering are adopted. Supply chain experts within the renewable energy sector will be administered

a questionnaire after which a semi-structured interview will be conducted based on the findings of the survey to add some robustness to the findings of the research.

The expected output of this research will be a theoretical framework of Industry 4.0 driven GSCM to tackle sustainability and supply chain problems in the renewable energy sector. This research is expected to contribute to the body of knowledge on Industry 4.0 driven GSCM and the renewable energy sector research which all together will have positive impact on policy makers and industry practitioners on their problem solving strategies within the sector.

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Design of Sustainable and Resilient Food Bank Supply Chain Network under Uncertainty

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Keywords: Sustainability, Food Bank, Supply Chain Network Design

For many years, both commercial and academic circles have paid a lot of attention to supply chain management and creating an effective network design. However, this study focuses on the supply chain network design of a non-profit organization, specifically food banks, rather than commercial organizations. The aim is to explore how a non-profit organization can create an efficient supply chain network design.

Non-profit organizations, such as food banks, share some similarities with industrial organizations in terms of supply chain network design, but they also have distinct characteristics. Food banks, for example, collect food from various sources, store them, and distribute them to people in need through various charitable organizations (Martins et al., 2019). Figure 1 illustrates the typical components of a food bank's supply chain in a developed country and its position within the broader supply chain network.

Food banks face unique challenges and limitations that set them apart from commercial organizations in terms of supply chain management. Unlike commercial organizations, food banks prioritize environmental and social goals over financial returns. Therefore, it is crucial for them to develop sustainable capabilities in order to support the sustainability of the food supply chain. One way to achieve this is by identifying the best warehouse locations and determining the capacity of food banks, which not only improves environmental and social impacts but also leads to cost savings and better operational performance (Martins et al., 2019).

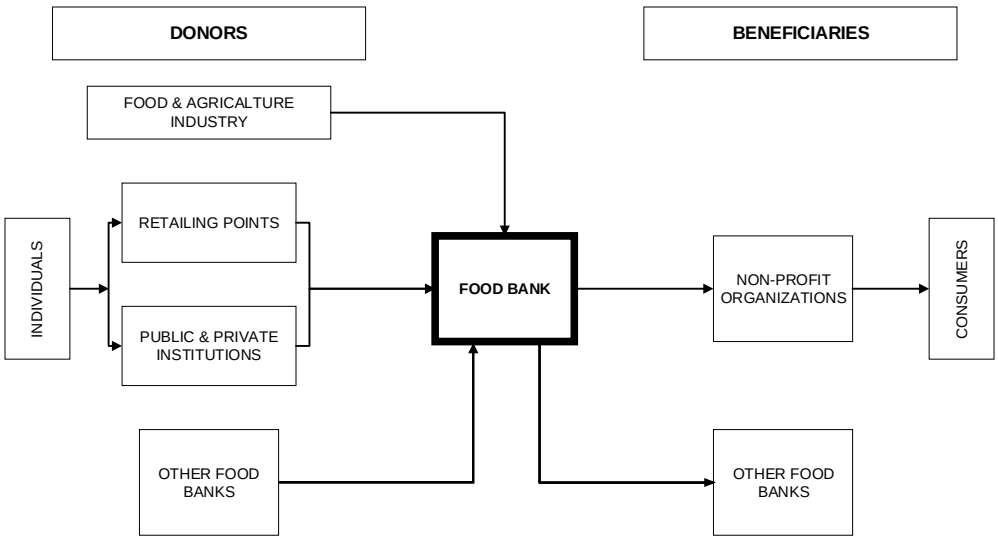

Figure 1: Food banks in a supply chain (González-Torre and Coque 2016)

The second important skill to be addressed in this study is resilience, which refers to a system's ability to return to its original conditions or establish alternative responses to minimize the impact of potential disruptions. To develop this skill, the study will focus on the variability in demand, particularly during peak and low periods (Martins et al., 2019). By doing so, the study aims to improve the ability of food banks to overcome challenges and ensure the continuity of their operations.

To reinforce the sustainability and resilience of supply chains and operations, it is necessary to develop conceptual frameworks and models that encompass all relevant actors (Zavala-Alcívar, 2020). However, while much research has focused on network design for industrial organizations, food bank organizations have received less attention in the literature. Therefore, this study aims to create a mathematical model for food bank supply chain networks, considering the organisation's economic, environmental, social, and resilience skills.

This study is expected to bring several benefits to both food banks and society as a whole. These include the potential for cost reduction, reducing and controlling food waste, improving relationships with donors and those in need, maintaining flexibility among partners, reducing transportation costs and time, minimizing harm to the environment, and increasing flexibility in responding to disruptions. To our knowledge, this will be the first attempt to design a food aid supply chain network with a focus on sustainability and resilience.

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Design, Analysis, and the Control of a Multiport-Isolated Bidirectional DC-DC Converter for Hydrogen Storage Systems

Oyedotun E. Oyewole

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Keywords: *Cross-coupling, Hydrogen Storage System, PI Controller, Triple Active Bridge*

Hydrogen energy storage has been the focus of systematic investigation for years, owing to its environmentally friendly implications. This is because the process produces two outputs, hydrogen, and oxygen, with hydrogen being generated through electrolysis using electrolyzers (EL). Hydrogen can be stored or used immediately, whereas oxygen diffuses into the environment. The stored hydrogen can then be used to generate electricity through Fuel Cells (FC), which can solve immediate and long-term energy demands, as well as for domestic heating, commercial heating, vehicular fuel, and domestic cooking. Hydrogen technology involves three major stages: hydrogen production, storage, and re-electrification. However, the efficiency and integrity of these systems depend on the integrity of their power electronic interface, which is known as a converter. Therefore, the modelling, design, and control of power electronic interfacing systems are major areas of focus in this research.

An electronic converter converts electrical energy from one form to another. They are critical for increasing/decreasing the voltage and producing the required voltage conditioning. Several studies have been reported in the literature regarding converters used for FC, but very few have been reported regarding converters for EL. Traditionally, multiple conversion stages are required, owing to the FC and EL having different independently operating converters. This results in a bulky system, increased cost, and increased effect of circulating current in each leg of the converter, and thus lower system efficiency. The Multiport-isolated DC-DC converter is designed to reduce the number of conversion stages and complexity and improve power density, fault tolerance, and general system efficiency by maintaining one conversion stage between EL, FC, and the source, thus possessing a significant advantage over other interfacing topologies. They are an essential derivation from the principles of a dual active bridge, with the addition of more legs to either side of the transformer. This can result in symmetric or asymmetric configurations. A 1:2 asymmetric triple-active bridge configuration was analysed in this study.

However, issues limiting the efficiency of such converters include slower dynamic response to disturbances, high circulating current, loss of soft switching at voltage mismatch, and the coupling effect of control variables. Most control models available in the literature are generated from nonlinear steady-state equations that neglect transformer current dynamism. This study aims to model and design a multiport-isolated converter with a decoupling controller to limit or eliminate the cross-coupling issues of the converter, leading to improved system stability, dynamic performance, efficiency, and adequate system balancing. A typical multiport-isolated DC-DC Converter with three ports called a Triple Active Bridge (TAB) acts as a multiple-input multiple-output system with an H-bridge rectifier, phase shifts as the control variable, and a duty ratio maintained at 50% at each bridge. Power transfer is influenced by the

leakage inductance of the high-frequency transformer, which is determined by the phase shift of each full-bridge control signal. A typical TAB has six possible modes; however, only three are essential for hydrogen energy storage applications. Three different modes of the hydrogen storage system were simulated using a simple PI closed-loop control, and efficiencies of 98%, 97%, and 95% were recorded for each mode of operation. The converter demonstrates soft switching, as long as the voltage ratio is unity. Generalised average modelling of the converter is also presented to understand the transformer current dynamics.

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Prediction of Acid Dissociation Constant Values through use of a Machine Learning Potential

Ross J. Urquhart[a], Alex van Teijlingen[a], Tell Tuttle[a]

[a] University of Strathclyde, Department of Pure and Applied Chemistry

Keywords: *Machine Learning, Computational Chemistry, pK_a prediction, Physicochemical properties*

Acid dissociation constant (pK_a) is a property that is of huge importance in many areas of chemistry such as drug development and general organic synthesis. It describes the ability of molecule to be in a charged (ionized) state. This in turn can have an impact on things such as stability, toxicity and potency of drugs. pK_a values also have a large effect on the ability of drug molecules being able to reach their intended target site, subsequently preventing possible issues such as off target effects when correctly understood.

Empirically, pK_a values can be determined through certain measurements by ascertaining the pH value for which charged and non-charged groups on the molecule are equal.[1] This can be done physically in a lab or the pK_a can be determined theoretically by carrying out computational calculations. This has proven to be quite an involved and challenging process with small variations in calculation results translating to a large difference in predicted pK_a values. Previous attempts to predict the pK_a values of certain molecules and structures have been undertaken to varying degrees of success.[2, 3]

In recent years Machine Learning (ML) has become largely accessible to most as the technical hardware requirements are reduced and more powerful computers become the norm. In the field of chemistry, the ANAKIN-ME[4] (ANI) models have seen large success in their ability to vastly reduce the time of calculations by using a machine learning model to predict the energies of molecules that would normally take much longer to calculate through traditional means such as Density Functional Theory (DFT).

Within this work, we have employed ANI in the calculation of energies for use in determination of pK_a values of a group of molecules in different solvents. The solvents chosen include aqueous (water) and non-aqueous (acetonitrile and dimethylsulfoxide, DMSO) in order to give a more rounded scope to the work. Employing a mixture of DFT calculations as validation we have predicted the pK_a values of carbene based molecules. By highlighting the ability of computational methods, such as DFT and ML for predicting such values we are hopeful to reduce the need for laboratory testing of such experiments in the future. This would reduce the need for solvents which can be toxic to humans and the environment, whilst also reducing the need for solvents of which the production process can be energy intensive and of harm to the environment.

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Intelligent and Robust Control of Space Manipulator for Active Removal of Space Debris

Shabadini Sampath

Keywords: *Space Sustainability, Active Debris Removal, GNC, Intelligent Controllers*

With huge kinetic energy, space debris poses a major threat to astronauts' space activities and spacecraft in orbit if a collision happens. The active removal of space debris is required in order to avoid frequent collisions that would occur. In addition, the amount of space debris will increase uncontrollably posing threat to the safety of the entire space system. But the safe and reliable removal of large-scale space debris has been a huge challenge to date. During the process of capturing and deorbiting space debris, the space manipulator has to achieve high control precision. However, due to uncertainties and unknown disturbances, there is difficulty in coordinating the control of the space manipulator. To address this challenge, this paper focuses on developing a robust and intelligent control algorithm that controls joint movement and restricts it on the sliding manifold by reducing uncertainties. A neural network adaptive sliding mode controller (NSMC) is applied with the objective to find the control law such that the joint motions of the space manipulator follow the given trajectory. A computed torque control (CTC) is an effective motion control strategy that is used in this paper for computing space manipulator arm torque to generate the required motion. NSMC will serve as a compensator to CTC such that the joint motions of the robotic manipulator follow the desired trajectories. Based on the Lyapunov stability theorem, the proposed intelligent controller NSMCTC guarantees the robustness and global asymptotic stability of the closed-loop control system. Finally, the controllers used in the paper are modelled and simulated using MATLAB Simulink. The results are presented to prove the effectiveness of the proposed controller approach.

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Development of a High-pressure Vessel for Measurement and Validation of High Pressure and Temperature Tuneable Diode Laser Spectroscopy for Advancement of Gas Turbine Engines.

Stuart Clark, Dr Ian Armstrong [a], Dr Michael Lengden [b] etc.

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Keywords: *tuneable diode laser absorption spectroscopy, gas sensors, optical sensors, gas turbines, aerospace*

Air travel has become an integral part of modern life but is a significant contributor to climate change. As the world moves towards a low carbon future, airlines face significant challenges to achieve the UK governments “Jet-Zero” target by 2050 [1].

A better understanding of the combustion process is required to ensure continued efficiency improvements in current gas turbine engines and to measure the performance of alternative fuels, such as synthetic or hydrogen fuels; this can be achieved by accurately measuring the gas parameters and distribution of combustion gases, particularly understanding the relationship between the quantities of reactants and products before, during, and following combustion. Tuneable diode laser spectroscopy is an a non-intrusive, in-situ technique which can be used for the measurement of the concentration, pressure, and temperature of gas species using high repetition rates and in hostile environments [2]. The gas parameters can be obtained from the experimental data by fitting to modelled gas absorption spectra calculated from a database of line parameters, such as the *hi*gh-resolution *tran*smission molecular absorption database (HITRAN).

At the temperature and pressures found in gas turbine engines HITRAN does not accurately model the absorption spectra, resulting in large confidence intervals. It is therefore essential for an improved model to be developed, requiring a detailed investigation of the absorption spectra of key combustion gas species in a controlled high temperature and pressure environment. A high pressure and temperature near-infrared spectrometer was built for the interrogation of the absorption features of key pollutant species (CO_2, CO, H_2O) in a controlled environment to improve the confidence interval of the modelling of combustion gases at these wavelengths. This presentation focuses on studies of water vapour and CO_2 spectral features at 1964 and 1999 nm. These wavelengths ranges were chosen to allow for the simultaneous measurement of both CO2 and H2O spectral absorption features; to enable temperature measurements of the gas can by ratio thermometry; and the availability of off the mature optical amplifiers at these wavelengths for distribution for chemical species tomography.

The improved modelling approach will inform and verify a multi-species tomographic imaging system for use in both exhaust and in-combustor applications. The tomographic imaging system will provide significantly improved spatial distribution of both temperature and combustion gas distribution and gas concentration at high sampling rate [3]. This will allow for the better understanding of the emissions

generation processes and the influence of fuel compositions, enabling the development of more efficient and sustainable aviation.

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Development of a Novel Solid Oxide Cell Material for on-demand Production of Hydrogen and Electricity

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Keywords: *Perovskite, Exsolution, Nanoparticles, Hydrogen, Power generation*

Reversible solid oxide cells (RSOCs) are known for producing green hydrogen in electrolytic cell mode and, in reverse, producing electricity in fuel cell mode. Hence, RSOCs have the advantage of enabling the on-demand production of hydrogen and electricity and solving the problem of intermittent supply of renewable energy.[1]

However, the commercialization of RSOCs has been hindered by the need for efficient materials suitable for operation as solid oxide electrolytic cell and solid oxide fuel cell electrodes. Furthermore, multiple electrochemical requirements, including catalytic and electrochemical stability, must be met in materials needed for RSOCs electrode fabrication.

Developing materials capable of enhanced exsolution process offers some possibilities for solving this problem. Exsolution entails the segregation of metallic cations to form highly active and anchored nanoparticles on the surface of a perovskite lattice – enhancing catalytic and electrochemical stability in the material. Forming such nanoparticles within the bulk of the perovskite lattice (bulk exsolution) has recently improved ionic conductivity.[2,3]

Therefore, this research sought to develop a novel perovskite material that is capable of surface and bulk exsolution processes to fulfil the stability and electrochemical requirements of RSOCs.

Five potential precursor materials were studied to ascertain their suitability and develop a synthesis route for the novel perovskite material. The study involved detailed characterization of the potential precursor materials via thermogravimetry analysis (TGA), scanning electron microscopy (SEM), and X-Ray diffraction (XRD) analysis.

The TGA results revealed Fe_2O_3, NiO, SrO and CaO as the decomposition products of the respective precursor materials, which are valuable oxides desired in the novel perovskite. However, TiO_2 was stable within the other precursors' decomposition temperature range (50 – 900 ^oC). The TGA result, therefore, predicted that the chemical reaction to form the

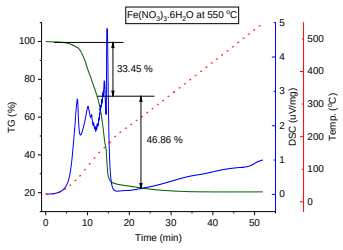

Fig. 1. A TG curve, DSC curve, and temperature response for $Fe(NO_3)_3.9H_2O$

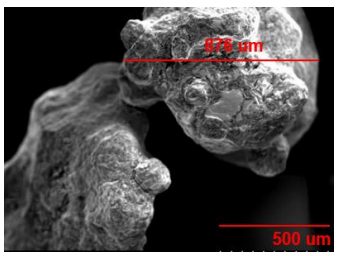

Fig. 2. The SEM image of $Fe(NO_2)_3.9H_2O$

desired perovskite would likely be in the temperature range of 600 – 1000 ^{o}C. Hence, a modified solid-state synthesis method was adopted for the novel perovskite synthesis. Fig. 1. shows a combine thermogravimetry (TG) curve, differential scanning calorimetry (DSC) curve and temperature response for $Fe(NO_3)_3.9H_2O$, while Fig. 2. shows the SEM image for $Fe(NO_3)_3.9H_2O$. The TG curve shows the change in weight of the material with respect to temperature and time while the DSC curve shows the different chemical reactions and phase changes during the process. Therefore, TGA result can give additional information like the purity and stability of a material.

From the two different compositions of the perovskite samples synthesized already, it can be concluded that homogeneous mixing of the precursors prior to their calcination encouraged homogeneous dispersion of species in the perovskite particles.

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An Innovative Urban Green-blue Infrastructure Framework for Implementing Nature-based Solutions in Cities

Shahrzad Zeinali

Keywords: *Nature-based solutions, green-blue infrastructure, innovation, urban framework*

The impacts of climate change across the world have led to global effects on multiple levels such as a higher probability of extreme weather events. People, animals, and green spaces in the cities first experience these effects. As around half of the human population globally lives in urban areas, these effects are critical for people living in cities. As cities have started to act on climate change and sustainability, it has become clear that some of the most effective responses are those that have multiple benefits such as nature-based solutions (NBS), an umbrella concept that can provide a promising approach to addressing urban sustainability challenges. It encompasses a range of ecosystem-related approaches inspired and supported by nature, aimed at providing environmental, social, and economic benefits to cities. Green-blue infrastructure (GBI), as a component of NBS studies, is a vital concept for climate change adaptation. With all the positive impacts of GBI, it seems that GBI, without considering NBS, will lack the merits of ecosystem services and therefore not only lose significant collaboration and management opportunities but also boost the chance of conflicted actions.

The aim of this research is to develop and test an innovative framework for implementing NBS in GBI in cities. A systematic literature review and case studies, including quantitative and qualitative research, will be used. Similarities and differences in structural conditions influencing GBI with the NBS approach between the selected cities will be analysed to identify the extent to which different contexts matter in terms of how structural conditions influence the application of NBS in GBI projects. The research findings will help to develop a framework for the application of NBS in GBI. Testing of the framework will be undertaken by presenting it to the professionals involved in decision-making, developing and implementing NBS in GBI in cities. Their feedback, i.e., answers to a survey and interviews, will inform further refinement of the proposed framework.

The research output will be of interest to decision-makers, stakeholders and users of urban spaces as well as to urban planners and designers. Through its application in practice, the residents of cities will enjoy an improved quality of life and well-being through better connections with nature in which ecosystems are preserved and biodiversity enhanced.

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Unleashing the Potential of Renewable Energy with Engineered Materials for Solid Oxide Cell

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Keywords: *Hydrogen, Solid Oxide Cell, Electrolyzer, Perovskites, Strain, Exsolution, Nanoparticles, Conductivity.*

The global net-zero emission target can be achieved and sustained by the development of novel energy conversion devices or by the improvement of features of existing technologies that utilize intermittent renewable sources to provide power when needed. This has led to a renewed interest in solid oxide cells (SOCs), which are highly efficient devices that can work both as electrolyzers and fuel cells. To enhance the performance of SOCs, three key properties need to be improved: ionic and electronic conductivities, as well as catalytic activity. [1] In this study, we explore a method to enhance the ionic conductivity of SOCs by introducing three-dimensional strain. This involves physically deforming the material by embedding nanoparticles into its structure.

We used computational modeling to understand how strain affects conductivity enhancement and conducted experimental work to validate our model. The model was developed based on data from previous studies involving the embedding of nanoparticles through thermal treatment method known as sintering, and exsolution processes which involves separating out the metallic particles to be dispersed within and at the surface of the host material. [2], [3]

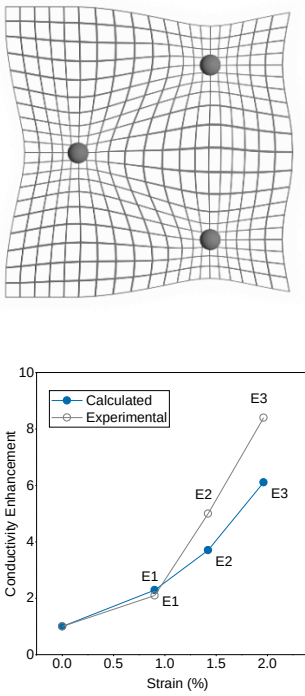

Figure 1. Strain-conductivity model visual representation and validation against experimental data for the E systems.

Using the model, nanoparticles of different sizes and concentrations were randomly placed within a small volume of the material to calculate the average distance between particles, the local strain between pairs of particles, and the overall volumetric strain within the volume. [1] The volumetric strain was then related to internal pressure and, subsequently, to conductivity enhancement of the material. [1] Figure 1 illustrates that the strain experienced in the exsolution process leads to a conductivity increase of approximately ~2–6, with strain levels ranging from ~0.9–2%. The results indicate that conductivity enhancement scales logarithmically with volumetric strain relative to the amount of embedded nanoparticles.

In the experimental work, perovskites, a type of ceramic material, were synthesized from precursor substances using the solid-state synthesis and their X-ray diffraction pattern were analyzed. The exsolved nanoparticles are anticipated to be

embedded within the perovskite matrix and on its surface. By exsolving metallic nanoparticles from these perovskites, we aim to understand the level of strain induced in the materials and its impact on oxide ion conductivity. This knowledge is crucial for efficiently converting energy in SOCs and will help us develop improved, three-dimensionally strained materials with enhanced conductivity for energy applications.

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Improved GPR and ERT Analysis for Crack Assessment in Concrete Structures

Muftah Abu Obaida

Keywords: *GPR, ERT, concrete, cracks, investigations.*

Concrete infrastructure structural integrity guarantees the safety and longevity of buildings, bridges, and other critical structures. Identifying and defining fractures in concrete has long been difficult for civil engineers, with traditional methods often offering little insight into the real level of damage. This PhD thesis includes a thorough investigation into using sophisticated Ground Penetrating Radar (GPR) and Electrical Resistivity Tomography (ERT) methods for non-destructive crack diagnosis in concrete structures.

The study starts with a detailed analysis of the literature, emphasising the present state-of-the-art in GPR and ERT applications for concrete evaluation and outlining the significant problems and limits in existing approaches. On this basis, the thesis creates novel approaches for combining GPR and ERT data to improve the identification and characterisation of fractures in concrete.

Numerous laboratory-based tests employing concrete specimens with varied fracture geometries, depths, and orientations were carried out to verify the suggested approaches. The findings show that the combined GPR and ERT technique is successful at precisely identifying and mapping cracks, as well as assessing their size and severity.

Using case studies, including the evaluation of damaged concrete buildings, the thesis also investigates the applicability of the offered approaches in real-world circumstances. The results show that the integrated GPR and ERT approach not only provides a more comprehensive understanding of structural health but it also has significant advantages over traditional techniques, such as improved accuracy, reduced testing time, and the ability to assess large areas with minimal disruption.

Finally, by inventing and testing new GPR and ERT approaches for the non-destructive study of fractures in concrete structures, this PhD thesis provides a substantial addition to the area of civil engineering. These novel approaches offer significant potential for improving the future safety, durability, and cost-effectiveness of concrete infrastructure.

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Synthetic Supramolecular Springs – Energy Transduction in Chemical-fuelled Rotating Nanoribbons

Hamish Swanson

Keywords: *Coarse-Grained, Molecular Dynamics, Reactivity, Self-Assembly, Peptides, Dynamic Systems*

Molecular self-assembly is the autonomous, and thermodynamically driven, coalescence of sub-units into extended structures with variable degrees of order (*i.e.*, from amorphous gels to nanotubes to crystals). [1] Living organisms can be thought of as complex assembly structures which exist out of thermodynamic equilibrium, requiring fuel to propagate (*e.g.*, light, carbohydrates/protein, and oxygen) and in doing so generating waste such as carbon dioxide or urea. Developing molecular self-assembly systems which exist out of equilibrium would enable temporal control of a systems properties.

In this research we are interested in the assembly characteristics of a short, functionalised peptide, FmocAVD. When this is temporarily chemically modified via reaction with a chemical fuel it undergoes assembly in solution into twisted nanotapes: which are sustained until the fuel is depleted. Following this the assembly structure undergoes a morphological transition firstly into flat ribbons, helical ribbons and eventually tubes.[2,3] This transition generates a torque, which can be harnessed to push objects, such as micron sized latex beads.

To move such material systems into real-world applications it is necessary to understand the intermolecular interactions that drive this structural change. For this purpose, we have developed a reactive coarse-grained (CG) forcefield, based on a new methodology developed in our group,[4] in which molecules are modelled as simplified groups of beads: vastly reducing computational expense, and chemical detail, though to a lesser extent. Further, this allows us to capture the reactivity inherent in the chemical modifications which induce this effect. We then corroborate these results with accurate quantum mechanical (QM) methods.

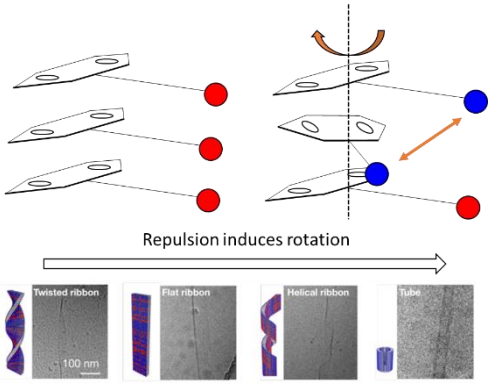

Figure 2. Attractive red beads give a twisted assembly structure which upon *conversion* to blue becomes first flat and then tubular as repulsion induces internal stacks to be less linear/ordered.

We explain this structural transition as being like a feedback loop in which the surface of the structure becomes more negatively charged, causing stacked molecules to push each other apart: as a result, the hydrophobic domain comprising the core of

the assembly structure is disrupted, which is thermodynamically unfavourable. As a result, this comparatively 'linear' stack compensates by distorting/extending and ultimately bending – leading to an equilibrium tubular state. This hypothesis is confirmed by measurements at a low-level of CG detail and at a higher level through quantum mechanical calculations and has relevance for out-of-equilibrium assembly system tunability, refinement and application.

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Technical Resource Assessment of Hybrid Wind Offshore – Tidal Stream Energy Systems

Marianella Bolivar Carbonell

Keywords: *tidal currents, offshore wind, hybrid system, renewable energy.*

The following work presents the development of renewable energy solutions combining wind and tide energy systems. A resource assessment analysis has been conducted in an area of Scotland, considering average wind and tide stream conditions. Tidal energy currents are regular and predictable depending on the relative motions of the sun, moon, and earth and therefore can provide a reliable source of energy. For the wind analysis, preliminary results indicate that the wind is generally from the north-east, with values ranging from 10m/s to 35m/s. The Weibull distribution shows an adequate fit with a predominant range of wind speeds between 11 - 15 m/s. Regarding the tidal stream resource, this study shows a spring-neap cycle for the same site with an approximate duration of 15 days, which reinforce each other (spring tide) or partially cancel each other out at neap tides, with values from about 1.5 m/s to 3m/s. The resource characterisation shows that analyses of this type should certainly include the historical characterisation of meteomarine phenomena, to calculate the energy distribution of variables over time, and thus identify an alternative way of knowing how best to establish the current tidal and wind conditions in each area. With this research, it is expected to contribute to the ongoing development of hybrid wind and tidal current systems, verifying initially the current resource assessment methodologies. Also, the contribution of this study will allow explore other areas of the United Kingdom and the world to assess the importance of this combined resource in terms of energy production, due to the availability of the resource, stability, and efficiency of supply.

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Great Britain's Electricity System – The Right Rules for the Right Equipment?

Susan Brush

Keywords: *energy storage, electricity markets, batteries, long-duration storage*

The UK Government's ambition to decarbonise our country's electricity system by 2035, as a stepping-stone to achieving Net Zero greenhouse gas emissions by 2050, presents opportunities and challenges. Britain has plentiful renewable energy resources, chiefly wind and sun, which will provide increasing shares of our energy needs, perhaps together with nuclear power. Fossil gas, to be phased out, meets much of our energy needs today, both for heating homes and businesses, and for fuelling power stations. Gas-fired power stations benefit from stores of gas in pipelines and gas fields: gas we don't burn today we could use tomorrow or later. In contrast, most of our renewable generation is inflexible. We can turn down wind and solar at times of high generation, but without some other kind of large-scale storage, we lose the energy. In contrast again, nuclear stations generate at constant output, and cannot respond to changing conditions. Our future electricity system, without large-scale gas or similar power stations, will be a very different beast to today's.

Our electricity system requires that generation and consumption must match exactly, second by second. So, without fossil gas and similar types of power station, energy storage is going to be key to "plugging the gap" – dealing with mismatches between our electricity consumption and generation.

I have been looking at likely behaviour of batteries – the most economically viable storage technology at present – and the extent to which it will "help the electricity grid", or perhaps not?

There has been an explosion in the numbers of battery projects seeking consent, though most are still at the planning or pre-construction stage. Owners of storage facilities are private entities, and thus must make good financial returns. What revenue streams can they access, and what is their behaviour likely to be?

Up until late last year, storage owners' business cases were largely returns from providing "ancillary services", i.e. being on standby to deliver a blast of power to the grid, in the event of a major fault at a power station or other equipment. Now, with many providers entering the market, prices for these services have fallen, and storage sites are seeking other sources of revenue.

An obvious initial assumption is that electricity market prices – which change from hour to hour, and day to day - will naturally incentivise storage (as well as generators) to act according to the power system's needs. I have explored likely battery behaviour through simulations of trading activity, i.e. buying energy when it is relatively cheap, and delivering at times of higher price. I have found that several different trading strategies can give good returns, so prediction of behaviour is difficult. Furthermore, the needs of the national electricity system can be different from those of local parts of the grid, to which batteries connect.

My analysis is still ongoing, but I have several interim conclusions. First, batteries can indeed be “part of the solution”, responding to short term price differences as well as providing vital system services. However, current rules incentivise batteries to trade according to national price signals, which may either alleviate or exacerbate local bottlenecks in the grid. Shrewd storage operators will switch between offering different services and trading strategies, even within the same day, to maximise returns. Looking more broadly, it is difficult to see how current types of batteries, which can deliver for around a couple of hours, can be the main vehicle to plug shortfalls in generation from weather-dependent renewables, where periods of excess or minimal generation can last for days or weeks. There is a clear need for much longer-duration storage, of timescales closer to generation or demand patterns; different market and financial conditions are needed to incentivise a broader mix of storage technologies, and potentially, different behaviours.

In my forthcoming work, I will seek ways that local electricity network owners in Scotland may facilitate storage deployment, while working within their own constraints.

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Structural Analysis of Offshore Pipelines to Prevent Oil Spills and Gas Leaks

Frederick Ebili

Keywords: *Offshore Pipeline, Oil and Gas, Explosions, Structural Defects, FEM*

The offshore oil and gas pipeline explosions are often undesirable catastrophic disasters that destroy lives and property and threaten the blue economy. The devasted environment, economic loss, and loss of lives and property are not exclusively unavoidable if structural design error, environmental factors, and pipeline routine checks are critically maintained to ensure adequate and safe operational measures. The ravaged offshore environment is a difficult task to recover from after explosions.

The research aims to conduct a robust structural analysis of offshore oil and gas pipelines and improve structural performance using a computational Finite Element Method (FEM) to ensure structural stability and integrity. However, the structural capability of offshore oil and gas carrying pipelines remains the utmost priority for this numerical investigation of cracks impunity and burst pressure capacity loss. The study will consolidate its current state of cutting-edge technology to deepen the offshore oil and gas pipeline structural failures analysis.

Therefore, the study will holistically simulate pipeline structural defects shapes and sections with FEM to understand structural failure modes and predict pipeline structural integrity for effective and efficient oil and gas transport.

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Inclusive Communities and Policies

Sustainable Urban Mobility: Inclusion of Marginalised Communities.

Alexandra Michnowicz, Martin Ferry [a], John Bachtler [b]

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Keywords: *Spatial Justice, Inclusivity, Sustainable Urban Mobility, Participatory Approaches, Marginalisation*

This PhD research investigates the use and impact of participatory approaches in the design and implementation of Sustainable Urban Mobility (SUM) initiatives, with a particular focus on communities that have traditionally been less engaged in public policy and planning.

SUM envisions various forms of active mobilities, such as walking, cycling and public transport services, becoming the most accessible, affordable, and reliable choice for citizens to get around in the city to complete their daily activities and errands (Werland, 2020). There is a critical need to challenge the domination of private automobiles which currently monopolise our public spaces. This is in response to tackling climate change, cutting down on carbon emissions and the recent covid pandemic. SUM is regarded as a solution, as by providing a safer and efficient means of mobility for citizens the urban challenges can be mitigated and resolved.

However, SUM initiatives must be carefully designed and implemented to avoid 'winners and losers' in the city. Some of the challenges that emerge in the political practice of 'doing inclusion' are the process of bringing powerful and marginalised stakeholders to have meaningful discussions and the struggles of balancing diversities to ensure that there is an equitable representation (Kok et al., 2021). SUM policy perspectives can be abstract and distant from spatial realities which could systematically exclude deprived communities inevitably making policy makers responsible for the root of the problem (Lucas, 2012).

It is important to recognise that it is not only the policies which are the way to make changes, as it can also happen from bottom-up approaches where under-represented citizens, who have poor accessibility to active forms of mobility, are advocating and demanding changes. It could be argued that this approach is a stronger push in driving changes as those directly impacted are initiating changes and want to improve their mobility and wellbeing. For example, participatory mapping where citizens are invited to plot on a map their concerns of where SUM initiatives have been in certain areas a struggle to meet could provide useful information to the policy makers and ultimately encourage collaboration between the two agents to reach a common ground (Mahmoudi et al., 2020).

This research therefore aims to bridge the gap between the policymaking and the voices of marginalised communities by using a mixed-methods approach (participatory mapping, NVivo coding software, interviews,). Participatory mapping,

which involves citizens pinpointing on a map where their home, work and daily errands are, can capture how they move in a city but also why they move. Spatial behaviour patterns can be picked up on a map such as the daily mobility patterns, the routes travelled and avoided. The qualitative research software (NVivo) will be another method used to analyse existing policy documents, by identifying themes of inclusivity and spatial justice, and any apparent gaps in the data sources. Interviews with policy makers, councillors, and representatives from the community will complement the participatory mapping and NVivo coding software to clarify how travel patterns look the way they do and to understand the nuances of mobility. By capturing the spatial narratives of the stakeholders from local communities and cross analysing this with what was already (or never) delivered by the policy makers then shortages can be identified which led to areas of social exclusions.

The North-East of Glasgow, Scotland, and the South of Rotterdam, Netherlands, will be used as case studies to explore how participatory approaches could bring potential in making better changes in achieving SUM initiatives inclusively. These cities are both port and post-industrial cities with similar economic histories (Doucet et al., 2011). From the 1970s, during the period of deindustrialisation, the two cities experienced sharp economic declines. In Glasgow many of the working-class population suffered from deprivation, while the South of Rotterdam became a hugely diverse city hosting to many ethnic minority migrants. Both cities were segregated spatially and socially which makes them potential case studies when studying deprivation, mobility issues, inclusivity, and social exclusion.

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Understanding the Cognitive Strengths of Adult Autistic Readers of Literary Narrative

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Keywords: *Autism, Literary Narratives, Neurodivergence, Cognitive Strengths*

In recent years, there has been a shift towards recognising autism as a form of neurodiversity, inherent to the natural diversity of human cognitive functioning, featuring differences in social and cognitive processing styles (see Manalili *et al.*, 2023). Such a shift not only signifies changing attitudes towards autism but an understanding that previous research has relied on medicalised, deficit-based models and theories of autism, which focus on the individual's' 'impairments' and 'functional abnormalities', and how they can become 'normalised' rather than accommodated for and respected for their differences (Pellicano and den Houting, 2021). Among approaches to autism through the neurodiversity paradigm are understanding and recognising the relative cognitive strengths of autistic individuals compared with the neurotypical population (Taylor *et al.*, 2023).

This paper relates the study of autistic strengths mentioned above to an ongoing PhD project investigating the cognitive traits of adult autistic readers of literary narrative. In general, the project seeks to understand, firstly, what the experiences of adult autistic readers may be; secondly, whether they are fundamentally different from, or similar to, neurotypical readers; and thirdly, whether their neurodivergence can illuminate what we know about literary narrative reading.

In the paper, I outline the approach that the project takes to addressing these issues, and how, in particular, it will serve to reinforce and emphasise the cognitive strengths that underpin autism, through its consideration of how such strengths are amplified by literary narrative reading. It provides, as a specific example of the project's goals, a close-reading analysis of text samples from Franz Kafka's fiction — an example of one of the key methods used in the project — in relation to inferring the mental states of fictional characters.

Inferring mental states involves determining what other people think and feel, and this is important for literary narrative reading too, because readers must be capable of inferring the mental states of characters, which can sometimes be made implicit in the text. Major accounts of autism suggest some deficit in theory of mind (ToM) abilities for autistic people (see Frith and Happé, 1994), which would, in theory, make the act of inferring mental states harder for these readers. Yet, in combination with more recent research on ToM in autism (Loza *et al.*, 2023), and through a careful analysis of how one might read Kafka's fiction, we may find that adult autistic readers could possess strengths in this area that we would not originally assume exist. One strength the paper suggests is that adult autistic readers, compared to neurotypical readers, might rely on different strategies in managing more efficiently complex literary representations of mental states, rather than demonstrating a specific 'deficit' in ToM processing. A potential strategy I draw attention to, for example, is the ability to use other, non-social cognitive resources (e.g. experiential knowledge and rule learning) to predict mental states in characters.

Towards the end of the paper, I suggest what implications this project might have for a neurodiversity framed, strengths-based approach to autism research and to literary research more generally. For autism research, one such implication is the project's potential to challenge prior perceptions about autistic people and their cognitive differences — particularly with respect to theory of mind 'deficits' and other 'deficit'-based theories. For literary research, the project seeks to shift researchers' focus away from forming generalised accounts of the cognitive abilities and literary experiences of readers to a consideration of the variety of abilities and experiences that underpin diversity in literary narrative reading.

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Inclusive Community and Immigrant Chinese Teachers' Identity in Scotland Chinese Schools

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Keywords: *inclusive community, Chinese immigrant, teacher identity, Scotland context*

Inclusive community building in Scotland should include the role of immigrant Chinese teachers, with particular attention to teacher identities. According to Wenger (1998), there are different manifestations of communities, not only those exist in society, but also include communities of practice. Scottish Chinese schools are a part of the social community, and they themselves are a community with a complex structure.

According to Andreouli et at. (2013), building inclusive communities should focus on the contexts and social relations that empower minoritized groups, to build inclusive schools/classrooms in the context of immigration and foreign language environments, it is necessary to leverage the role of immigrant Chinese teachers. The central role of teacher identity in teacher development is widely recognised (see Beauchamp & Thomas, 2009; Beijaard et al., 2004; Pennington & Richards, 2016), the role of the context in shaping the identity of teachers has been expounded upon (like Izadinia, 2013), but how teacher identity in turn affects the context, especially its impact on inclusive classrooms/schools/communities has not received sufficient attention.

This study plans to use a comprehensive qualitative research method, such as in-depth interviews, narrative inquiry, metaphors, etc., to investigate how the identity of immigrant teachers in Scottish Chinese schools affects the construction of inclusive classrooms. At the same time, the study also focuses on the views of immigrant Chinese teachers as members of the social community. It emphasizes the dynamic interaction between inclusive classrooms, immigrant Chinese teacher identity, and inclusive community.

This paper aims to raise awareness in Scottish society about the importance of the Chinese immigrant community, particularly the crucial role of Chinese immigrant teachers in building inclusive classrooms and inclusive society. Inclusive classrooms are essential for the academic success and social identity formation of immigrant children (Farmer et al., 2019; Specht & Kaneva, 2021;). As Guo-Brennan and Guo-Brennan said (2019) Chinese immigrant teachers and children can contribute to Scotland's social and cultural diversity, ultimately helping to build a harmonious and inclusive Scotland.

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Invisible Native Americans: Garifuna Communities in the Caribbean and around the World

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Keywords: *Garifuna, Indigenous Native Americans, Language, Oral History, Music*

On May 18, 2001, UNESCO issued a Proclamation that "Language, Dance, and Music of the Garifuna are Masterpieces of the Oral and Intangible Heritage of Humanity" in the countries of Belize, Guatemala, Honduras, and Nicaragua (UNESCO, 2008). Garifuna people, historically known as *Kalinago*, are a fusion of Arawak Indians, Carib Indians, and pre-Colombian Africans, who migrated from South America to the Caribbean in the 1300s, and have never been enslaved. Predating mass genocide and their 1797 exile and displacement to *Roatán*, Honduras, they successfully fought against European colonialism for over 300 years (Beckles, 1992; Murphy, 2021; Taylor, 2012). Presently, the denial of Indigenous Native American status, land rights, and equitable resource access, as well as commodification of Garifuna culture by the tourism industry and world music industry, threaten some Garifuna communities, specifically in Honduras, Belize, and Nicaragua. Conversely, in Guatemala, Garifuna communities in the towns of Livingston (called *Labuga* in Garifuna), and *Puerto Barrios*, appear minimally affected by these threats.

My research aims to contextualize and develop an interdisciplinary, Indigenous Garifuna framework to explore how Garifuna concepts of memory, time and space, landscapes, and seascapes/oceans might be expanded to a more general theory of agency and sustainable, ethical practices. The methodology will be grounded in methods from oral history, sociolinguistics, socio-anthropology, and archival history. Using this frame, my project will examine how *Labuga's* and *Puerto Barrios'* Garifuna communities interweave past and present in the *Pororo* tradition, through Garifuna language, oral history, and musical culture to promote heritage, belonging, and connection (Fletcher, 2022; Mons and Rodríguez, 2023; Rust, 2001). This annual Garifuna festival commemorates Our Lady of Guadalupe – the Indigenous Virgin Mary – on December 12th and has been celebrated for approximately 200 years in *Labuga* and about 40 years in *Puerto Barrios*.

As an Indigenous Garifuna researcher, I intend to create a more intercultural dialogue, internationally, regarding ideas of my heritage and community. My research methodology will be guided by the principles of *Garifunaduáü* ("The Garifuna Way" / "Garifuna beliefs and values"), which are rooted in community (relationships with each other, land, and sea), responsibility and betterment of society, reciprocity through respectful sharing of knowledge, and interconnectedness to all animate and inanimate things.

Empirical research on *Pororo* will be collected during fieldwork in *Labuga* and *Puerto Barrios* with adherence to Indigenous ethics and protocols during and after the research project is completed. Consultations with relevant *Pororo* management personnel will help determine adequate resources, and dates for observations and recordings, to collect primary data, such as: oral history, storytelling, recorded interviews, observations, and narrative and text analysis. Secondary data sources include journals, articles, newspapers, and published reports. Additionally, I am accessing Caribbean archives and research data in Scotland, the wider UK, and abroad.

The goal of this project is to develop an interdisciplinary, contextual Garifuna framework for studying and understanding Garifuna tangible and intangible heritage, management, and preservation, by examining *Pororo's* cultural practices. As Garifuna communities continue to face obstacles in their quest for Indigenous status, equitable access to resources, and land rights, it is my hope that this research will aid international, national, regional, and local entities in developing sustainable policies, programs, and preservation initiatives that will best serve, and positively impact, Garifuna communities and, by extension, other cultures worldwide.

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Gender and Feminism: An Exploration of Migrant (Lived) Experiences in Contemporary African Feminist Novels

Esther Chioma Uwanndu

Keywords: Migration, Gender, Transnational Feminism, Hybridity, Afropolitanism.

The work of many African feminist writers has focused closely on the topic of migration. This is because migration has historically been considered a male-dominated experience, with women existing as travel companions or mere appendages. However, we have recently witnessed the *feminisation* of migration, as more women, especially African women have begun to be involved not only in the migration process but in writing about it; not as appendages but individuals whose experiences and stories are worth telling. Significantly, many female African writers of1960s and 1970s have experienced migration themselves.

My paper seeks to explore the lived experiences of female African migrants in selected African-feminist novels. The aim of my research is to examine how issues such as race, class, gender, sexuality and voice intersect to affect the identities of African females in migration. African *feminists* (writers, critics, and individual women) are concerned with the place of the African woman in the society. These *feminists* are breaking long history of silence of African females, and bringing African women from the background into the mainstream. Through their works, they are telling and re-telling African women's stories in more audacious ways than had existed in previous centuries.

My research examines the works of African feminist writers like Adichie and Bulawayo among others. They have been selected because they are not only concerned with just tracing the trajectory of the mass migration of Africans to Europe, America, Britain and other parts of the world, but they aim to situate African women as equal players in migration, and making their experiences important issues in their fictional narratives. *Americanah* and *We Need New Names* among others, explore how female African migrants negotiate new identities in new environments. Among the recurring themes the novels explore are racism, gender and sexual exploitation, trafficking and prostitution, among others.

I am exploring these texts through the lens of transnational feminism. This feminist theory transcends nation-state boundaries and speaks to a wide range of interacting forces that have an impact on gendered relations and experiences in a geographical context; this theory also concerns itself with transnational subjects like women from multicultural backgrounds, occupying contested spaces. Transnational concepts such as hybridity, Afropolitanism, and return-migration among others are utilised to further explore the experiences of female African migrants. The significance of my research will help situate African feminist literature on migration as important and alternative exploration of African migrants' experiences, especially African women.

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A Structured Wicked and Complex Problem-based Analysis Framework

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Keywords: *Wicked Problems, Complex Problems, Supply Chains, Net Zero, Structured Framework*

Net Zero is a prominent global goal which is the focus of many research fields. This research can for example be around developing new innovations and technologies for enabling net zero or processes that need to be optimized to meet net zero, such as supply chains. Due to the interaction of many stakeholders across supply chains, optimising them to be sustainable can be classified as a complex problem, which are sometimes referred to as wicked problems that are often characterised by their interconnectedness. These are difficult to overcome with conventional problem solving and collaboration is a key part to approach these problems. As well as supply chains, Net Zero and climate change can be categorised as wicked problems that require specific approaches.

A framework from the literature has been adapted and refined through the review of literature on wicked problems and supply chains. The framework highlights the importance of considering two aspects of problems: the problem itself and the stakeholders involved with the problem. The two aspects are divided into three dimensions with an increasing degree of complexity.

To test the robustness and applicability of the framework, it is first analysed and refined using a report called Absolute Zero published by the UK FIRES research group. This report focuses on the actions that can be taken to establish Net Zero in the UK. Following the analysis, the refined framework is then used for the main part of the research that concentrates on a new roadmap for the Future Electrical Machines Manufacturing Hub which focuses on the developments and requirements of electrical machines for Net Zero.

The overall aim of the research is to determine whether the decomposition of wicked and complex problems into smaller and more approachable tame ones, as well as the positioning of the decomposed problems onto the framework is effective in helping the solving of the problem. This decomposition can occur in various layers which is expected to influence the overall effectiveness of solving the problem.

The research has an impact both in practical and research terms. It can help to classify decarbonisation and sustainability problems and according to the positioning suggest an approach. It can help managers and leaders to focus actions for approaching Net Zero.

In line with the conference themes of Horizons for Humanity, this research fits with Inclusive Communities and Policies. Net Zero is a global goal and actions need to be

taken on different levels: International, national, organisational, and even on the local community and personal level. The interactions and especially the collaboration between these different levels plays a key part in Net Zero. The framework that has been developed as part of this research can help to determine whether the level of actions is sufficient to meet the overall goals.

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Managing Frontstage and Backstage Behaviour: Rituals and Sustainable Theatrical Performance in Ecotourism

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Keywords: *Frontstage and Backstage Behaviour, Rituals, Sustainable Theatrical Performance, Ecotourism, Dramaturgy*

This study explores the management of tourists' frontstage and backstage behaviour in an ecotourism context seen from a dramaturgical lens. Unlike general tourism, ecotourism is liminal because such occasions are bounded more firmly than general tourism. Ecotourism has tight principles that must be followed by ecotourism tourists, i.e., less harm to the environment, studying flora and fauna, social and cultural, making sure that they come to preserve the environment by allocating their money for conservation and doing their best to improve the economic benefit for the residents.

Tourists who visit ecotourism destinations, called ecotourists, must understand their roles before visiting the sites and their views of what kind of performance they will accomplish in such places and follow those principles during their visits. Ecotourists will perform a multifaceted sensory activity creating a sense of totality and condensing themselves with learning and understanding the environment, flora, and fauna, and social and culture, called rituals. Since ecotourism is the most sustainable type of tourism, ecotourists will perform and sustainably establish their play. They will ensure that they are doing, and actions have minimal adverse environmental impacts. Both such rituals and sustainable drama are expected to meet ecotourism standards. Ecotourists must manage their front and backstage behaviour.

In ecotourism, tourists are assumed to have expectations about what they will accomplish at the ecotourism destination, bearing in mind that ecotourism principles involve many aspects (ecolodge, community, ecotourism venues) that have been prepared before their visit to a tourism destination. Not to mention that in the context of the ecotourism goals, they will get related to conservation efforts, learning about nature and flora and fauna and the length of stay in an isolated/remoted area which is usually a minimum of five days. They will be expected to perform in front of the locals, the tourism workers, guides, agents, ecolodge staff where they stay, conservationists, and other tourists. Backstage, in this case, is when the ecotourist needs to carry out ecotourism activities (back to the ecolodge, alone activities that other people do not see and things they do not expect from the ecotourism activity). The role of ecotourists must also be carried on when they return from ecotourism and do their mundane activities in society. So, these points must be examined how ecotourists consume ecotourism, what it means for them, and how they manage their frontstage with their backstage.

According to Goffman, in presenting their idealised version of themselves, the individual would engage in theatrical performance by creating specific audiences at a specific time that leads to frontstage and backstage performances. In frontstage performance, an individual will be cast as an actor performing in front of the audience, consciously following the rules and social conventions. In this stage, an individual

would portray himself positively to the outside world, attempting to guide the audience's impressions by altering their setting, appearance, and manners. On the other hand, the backstage performance is the region hidden from the outside world, in which it is private, and individuals can drop their social roles and identities. Both rituals and drama or play underlie ecotourist performance and the performance-making process.

This study will be situated within the interpretivism paradigm and take a qualitative approach with an in-depth interview. Scientifically speaking, understanding the frontstage and backstage contradictions will expand the understanding of ecotourists in consuming ecotourism so that they can further build ecotourism product mix and promotion mix and ecotourism destination images. Socially, ecotourism marketers can improve the meaningful experience for ecotourists. The concept of ecotourism is still comprehensive so that marketers can design a meaningful experience for ecotourists referring to ecotourism principles. This study thus will contribute to the consumption and consumer culture literature by highlighting the relevance of Goffman's dramaturgical frontage and backstage analogy in uncovering the consumer nature in experiencing rituals and sustainable dramatical performance.

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Information Seeking Behaviour of UK Retail Banking Consumers towards Online Purchase Adoption: An Integrated UTAUT2 Model

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Keywords: banking products, UTAUT2, information seeking, consumer behaviour, online purchasing

Research Context: Technological innovation has transformed and continues to redefine the way we live and do things, steadily changing the way consumers all over the world make purchases. The UK retail banking industry is also speedily moving towards digital business models leading to rapid branch closures. It is therefore of particular concern to understand consumer behaviour towards online purchasing of financial products. Worthy of note that retail banking sector has a huge impact on individuals and communities because everyone is either directly or indirectly affected by the services it provides.

Research Problem: Several studies have investigated consumers' intention to purchase products online but few have investigated willingness to purchase financial products and services online. Review of existing literature has shown that research related to UK retail banking consumers acceptance of technological innovation have mostly investigated intention to adopt banking services, such as mobile banking acceptance. The experiences and difficulties that consumers face at the start of the purchasing process, prior to the actual purchase, has not been fully investigated.

Additionally, most consumer related technology acceptance research have failed to acknowledge the impact of information and trust while investigating motivational factors that impact acceptance. However, the search and selection of information is a key part of the purchase decision making process and trust remains a pre-requisite to any online transaction. Ignoring these key factors has resulted in fragmented and insufficient understanding of consumer concerns. Also, banks need to do more to reduce financial exclusion by building consumer preferences into both service and product design and prioritising customer led proposition and change as part of strategic initiatives. This study therefore intends to fill such knowledge gap.

Research Questions: This research will answer the following questions: 1). What are the preferred primary information sources adopted by UK retail banking consumers prior to engaging in online purchasing? and what are the reasons and considerations behind the choice of primary information sources? 2). What are the information needs of UK retail banking consumers prior to engaging in online purchasing? 3). What factors motivate UK retail banking consumers' acceptance of online purchasing based on the proposed research model? 4). How can UK retail banks increase customers' trust towards the acceptance of online purchasing?

Methodology: In light of these, this research has two theoretical grounding – the Unified Theory of Acceptance and Use of Technology2 (UTAUT2) and the problem-specific Everyday Life Information Seeking (ELIS) model. The research adopted a quantitative approach through the use of a non-probability sampling technique. A sampling technique whereby not every member of the population has an equal chance

of being included in the research. Non-probability convenience sampling technique was adopted because the study population is large, a sample frame is unavailable and not every UK retail bank consumer has an equal chance of participation in the study. Participation is based on a set of criteria which includes consumers who own specific products, aged 18+, resident in the UK and physically and mentally capable of solely making a financial decision. Primary data is currently being collected from the target population post completion of pretesting. Collected data will be analysed through a statistical analysis tool PLS – SEM, to address the research objective and the underlying research questions.

Significance: This research will generate new knowledge and insights on UK retail banking customer behaviour towards the acceptance of online purchasing. It is expected that these new findings will provide sufficient information to make recommendations to, and support decision making by, bank policy makers, developers, and practitioners to continue to seek for ways to support the provisioning of products and services offered to consumers through the right channels and in a more digitally appealing way.

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Participatory Rights of Children in the Criminal Justice System of Scotland, United Kingdom and Lagos, Nigeria

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Keywords: *Criminal Justice, Participation, Children's Rights*

Children by their very nature are vulnerable and dependent due to their level of development and maturity. Hence require special attention and opportunities to be provided for them to ensure they shun crimes and become law abiding citizens. The most vulnerable of children are those born into poverty, in detention, and with disabilities, as such, they are usually left behind on account of discrimination and prejudice. Nevertheless, the UN 2030 agenda for Sustainable Development Goals (SDG)[1], goal 16 in particular, calls for inclusion of everyone and emphasizes on the need not to leave anyone behind.

Child-friendly justice system is a holistic term that applies to all children in contact with the law and it is recognized as one 'that involves treatment of children offenders in a manner that seeks to understand the root causes of their criminal behaviours and ways to prevent such behaviour with the aim of upholding human rights principles and justice for children'[2]. Children's rights are internationally recognized and contained in the United Nations Convention on the Rights of the Child (UNCRC), 1989 which is the most ratified international human rights instrument having been ratified by 196 countries except the USA and Somalia. Consequently, the UNCRC is considered as an important document for understanding and implementing the rights of children by identifying children as rights-holders, thereby making them 'subjects of the rights and not just objects of adult protection'[3]. It also recognizes children as autonomous beings capable of agency who are able to take part in decisions affecting their lives. The UNCRC stipulates in Article 12 that children should have the opportunity to express views in matters affecting their lives and such views should be given due weight in accordance with the age and maturity of the child. It further provides that children should be heard in any judicial and administrative proceedings affecting the child. Article 12 is crucial for children as it ensures not only their participation in decision-making processes but offers protection against abuse, violence and violation of rights. Unfortunately, since the coming into effect of the UNCRC, the implementation of children's participatory rights have been unsatisfactory as many countries still struggle with long-standing cultures and attitudes,[4] which see children as objects of adult's decisions as well as socio-economic barriers.

Thus, this study is a comparative analysis of the child-friendly justice system in Scotland, UK and Lagos, Nigeria with focus on the practical implementation of children's participatory rights by those involved in apprehension, adjudication, and correction of offending behaviour of children. It argues that by providing opportunity for children to express their views freely in the criminal justice proceedings and

considering such views in the decision making at various stages of the justice system, the children feel valued and respected, making it easier for their reformation and reintegration into the society. It has been suggested that 'treating children as active participants rather than passive objects contributes to an effective response to his/her behaviour and improves the possibility of successful completion of the measures and of reintegration'[1]. This project involves understanding the mechanisms and strategies for promoting participatory rights of children in Scotland and Lagos with the aim of identifying factors that need to be addressed and to ensure a more robust child-friendly justice system.

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Desperately Seeking Men: The Case of Speech Therapy

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Keywords: speech therapy, history, men.

Speech therapy is not exclusively a female enterprise, however the majority of practitioners, at least since the 1920s have been women. The first formal register, of 1942, included a total of eighty five names, of whom just five, including Lionel Logue of '*King's Speech'* fame, were men. Over the next three decades only a further forty four men joined the register and today the proportion of men is around five percent of the total speech therapy profession. The aim of this paper is to discuss approaches to collecting information which might explain the motivations, opportunities and career trajectories of the rare men who became speech therapists.

Data sources include written and oral material. Written material has been drawn from archives, public biographies and private correspondence. The main source is the archive of the Royal College of Speech and Language Therapists (RCSLT). Structured searches of the National Archives at Kew, the Wellcome Trust, the National Records and the National Library of Scotland, have been carried out in order to follow up information on some of the men who remained professionally active. These have been complemented by serendipitous findings located in other diverse and scattered archives. Private personal papers and correspondence of (although not between) two men, Lionel Logue and Leopold Stein, have been generously shared with the author by their custodians, giving valuable insights into their lives and their very differing views on speech disorder.

Publicly available speech therapy registers were issued in Britain until 2004. Searches of relevant names from these located accessible biographies for a few men, mostly in professional body outlines and obituaries, but also in personal web sites in the public domain. In addition, oral histories have been collected from seven male speech therapists listed in the registers, who qualified in the 1970s and agreed to take part.

Analysis has only recently commenced. Evaluation of written and oral primary source material is drawing on narrative, discourse and content analysis. While the study is adopting a qualitative approach, it is recognized that it needs to reflect the quantitative concepts of reliability and validity. Every attempt is being made to ensure the procedure is rigorous and the findings are trustworthy, that is: credible, dependable, and confirmable. Early indications are that while speech therapy feminized over the twentieth century, the men who remained in the profession benefitted from their gender. A marriage bar meant that for many years women were required to 'retire' on marriage, social convention meant that many more left the profession or at least took a career break when they had children and so had lost professional ground if they did return. On the other hand, pay was poor for the majority of the century, which may have influenced those men who left the country or the profession. The paper argues that in the twentieth century, a career in speech therapy was both constructed and constrained by gender.

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Improving Cybercrime Reporting in Scotland: The Victims' Perspective

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Keywords: *Cybercrime, Victims, Reporting, Policing, Scotland.*

People victimised by cybercrime can feel excluded within their communities due to shame, which results in underreporting cybercrime. This research builds on earlier work by Sikra, Renaud and Thomas (2023), which used a systematic literature review to establish a theoretical foundation for improving economic cybercrime reporting in Scotland. Using the paradigms from the latter, this research focuses on three types of Scottish victims of cybercrime (SVC): Individuals, Private institutions and Public institutions. It analyses their reporting experiences via the taxonomy of Human-to-human (H2H), Human-to-machine (H2M) and Machine-to-machine (M2M). Importantly, it adds value to the research subject by using victims' own views on what is required to improve cybercrime reporting in Scotland. In doing so, it is addressing a research gap whereby there is currently no research with victims on how to improve cybercrime reporting in Scotland.

This study used a qualitative semi-structured interview design to collect information from SVC about their background, the cybercrime they had to endure as well as their experiences of reporting and suggestions for improvement.

Participants were recruited using several methods. Firstly, in cases of Private and Public institutions, news coverage was followed-up for news of prominent cybercrimes based on which potential interview candidates were contacted. Secondly, all researchers' private connections were explored. Thirdly, snowballing participants was used. Fourthly, recruitment was done via social media. There was a total of 10 SVC (9 males, 1 female): 3 Individual SVC who incurred cybercrime harm of £1000, £5240, and £20. 2 Private institution SVC who incurred cybercrime harm of over £20,000 and non-monetary harm. 5 Public institutions, represented by various functions, which suffered technological and psychological harms. All the cybercrimes were from the years: 2012 (1), 2015 (2), 2017 (1), 2020 (1), 2021 (3) and 2022 (2), where the number of interviewees is in brackets.

Approval for the study was granted by the CIS Departmental ethics committee 7 times from 22 April 2022 – 09 January 2023. Most of these were extensions to the original application due to substantial problems with participant recruitment. The analysis was carried out with 'NVivo 1.3 Release software' in three stages which were: Stage 1: Initial coding, Stage 2: Focused coding, Stage 3: Thematic coding.

Individual SVC were attacked via an E-Bay Scam, HMRC Scam and Credit card details theft. Individual SVC link improved reporting to aftercare and returned finances. Individual SVC link impeded reporting to anxiety and frustration with the Police. All individual SVC reported via H2H approaches. Private institution SVC were attacked via .ru ransomware. Private institution SVC link improved reporting to having a unified phone number, awareness raising and a possibility to report online. Private institutions

SVC link impeded reporting to unpreparedness of the local Police as well as not knowing who to report to. Private institution SVC reported via H2H approaches, but only one reported to the Police. The other reported to their IT company. Public institution SVC were attacked via fraudulent invoices, ransomware, and a vendetta-motivated cybercrime. Public institution SVC link improved reporting to following procedures and taking a multistakeholder approach among others. Public institution SVC link impeded reporting to Police being unhelpful and terminological confusion. All Public institutions SVC reported via H2H approaches both to the Police and multiple other interested agencies in most cases.

Since all SVC reported via H2H approaches this suggests that it is the dominant mode of reporting currently utilised in Scotland implying a proclivity towards a socially inclusive preference, which suggests that the way to improve cybercrime reporting should be social rather than purely technical.

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Boko Haram's Media Offensive and Government's Counterinsurgency Efforts: Towards Strategic Communication Solution

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Keywords: *Boko Haram, Counterinsurgency, Media Offensive, Political Communication, Propaganda*

Boko Haram is an extremist group established by an Islamic cleric, Yusuf Muhammad in Borno State, Northeastern Nigeria in 2002. The gory report of the killing of the sect's leader by Mike Hanna of Al-Jazeera made the movement vicious (Kukah, 2014). Since 2009, the jihadi group has killed about 35,000 people and displaced 1.8 million others in Borno, Adamawa and Yobe States (Ballason, 2022). They also abducted over 200 girls from Chibok on April 14, 2014, and 110 Dapchi schoolgirls on February 19, 2018 (Kupoluyi, 2018). The sect deploys asymmetric-war tactics which require ideological responses. The researcher leverages on his lived experience of living in Northern Nigeria for the past 40 years. This is in addition to being a survivor of Boko Haram attack in Azare, Bauchi State on 4 December 2011, and a journalist and a researcher who has written about the insurgency.

The study is guided by these research questions - How has Boko Haram carried out its media campaigns as a weapon of war? Is the Nigerian government succeeding in its media approach to engage the insurgents? What is the place of strategic communication in countering the insurgency? Its objectives include - Investigating the *modus operandi* of Boko Haram insurgents considering their media war against the Nigerian state; interrogating the ideological stance of the government in containing the insurgents through strategic communication and the lived experience of key actors; examining counterinsurgency narratives in Iraq, Afghanistan, Libya and Somalia towards learning from international practices, and investigating the place of strategic communication in the insurgency.

The research adopts the qualitative method. Primary data will be drawn from fieldwork in Nigeria. Through in-depth semi-structured interviews, primary data will be generated from 20 interviewees who have experience about the insurgency: A - 4 officers of the Nigerian Army; B - 4 spokesmen of government; C - 4 journalists covering the insurgency; D - 4 victims of BH onslaught, and E - 4 Counterinsurgency Experts. The researcher will use purposive sampling to identify and select information from interviewees at the Defense Headquarters (DHQ) Abuja, Nigeria's capital because the insurgents are fighting against the Nigerian government; the Nigerian Defence Academy and School of Counterinsurgency, Kaduna because these institutions are strategic to government's counterinsurgency operations, and Borno, the epicentre of the insurgency where the Army Theatre Command is located.

Strategic communication, political communication and propaganda are essential tools for counterterrorism (Bolt, 2014; Kitzen, 2012; Krawchuk, 2016). However, instead of using the principles of strategic communication, state communicators are

contending with information management, not information control (Bolt, 2014). This creates a gap which the study investigates using research principles. The study applies existing methods of strategic communication which rely on military approaches to make a case for non-violent strategies while proposing new methods - an afro-multidimensional strategic communication which "wins hearts and minds" (Reding, Weed & Ghez, 2010), and contributes to knowledge. The study is grounded in current research. It elicits change in government's political communication policy and current non-violent approaches through a homegrown strategy that benefits Internally Displaced Persons, refugees in neighbouring countries across Niger, Chad and Cameroon, the Nigerian government and people, leaders of African Union, and the international community.

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Strengthening the Liability for Online Copyright Infringement of Short Videos on Short Video Platforms

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Keywords: *Short video, Short video platforms, Internet service providers, Infringement liability, Online copyright infringement*

Due to the high degree of popularity and attractiveness of short videos, the scale of short video markets and online users tends to increase year by year globally. It not only promotes the potential development of short video industries but also raises challenges to the effectiveness of copyright protection in the emergence of short videos after the rapid development of internet technology. Because of the combination of the emergence of short videos and the lack of certain terms, boundaries, and interpretations related to short videos in legislation, there is a common and confused short video infringement phenomenon in China, resulting in an increasing number of copyright infringement cases by courts: For example, a large number of repeated infringing (including cutting, editing, rearranging, moving, redrafting, broadcasting and rebroadcasting other's works without permission), and highly likely infringing short videos (mash-up videos and secondary creation videos) exist in the short video platform, indicating that the platforms are becoming a high-risk area for short video infringement and a grey area for copyright protection with the increasing number of infringing short videos by the copyright monitoring centre in China.

This study aims to assess the importance of how to improve the current legal liability of the platforms for online copyright infringement of short videos in China. Using a mixed-methods approach, my research combines black-letter law with a comparative case study between the United States (US) and China. The comparison will study lessons from copyright norms in the US, in particular, the provisions dealing with the infringement of short videos in China's copyright law are basically consistent with those in the US ("Safe Harbour Rules", "Notice-and-takedown Rules", "Fair Use", etc.), but from the perspective of judicial practice, there are differences. Additionally, in terms of the historical development of short videos, the birth of short videos in the US is earlier than that in China. However, compared with the development potential and diversity of short videos, China is more advanced. Therefore, the differences in these similar provisions between the two countries and further optimization in the future are analyzed through comparative research. The black-letter law approach will systematise the well-established legal rules. Case study is to discover multiple perspectives for similar cases in these two different jurisdictions and to demonstrate how the same terms of the law have been applied differently in judicial practice.

Furthermore, the selected research methodologies will also contribute to the research from another aspect—identifying loopholes in both US and China's copyright laws. For example, the identification of Internet service providers (ISPs) is outdated because the identification of it has changed with the development of technology. ISPs have switched from single-function providers to strongly integrated providers in the current. It is, therefore, inappropriate to apply the old terms and elements of ISPs to regulate the current platforms, such as short video platforms. Hence, the definition and characteristics of current ISPs should be classified and re-identified in copyright laws.

However, in the US, the allocation and component of each copyright infringement liability for platforms are more unified, coherent, and certain than in China. Therefore, the paper claims that the experience of the legal liability of platforms for online copyright infringement in the US is something that China can learn from.

Although this study mainly focuses on the chaos of short video infringement in China, with the short video market entering the international market and being popular overseas, the problem of short video infringement is a challenge for Chinese laws as well as a worldwide problem. In terms of the perspective of the historical development of short videos and the establishment of relevant legal provisions of copyright law, the US is more advanced than China, but the problems raised by short videos in China are changing faster than in the US. Therefore, the study of Chinese short videos has the potential to enhance our knowledge and understanding of similar challenges in other countries.

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Factors that Affect Mobile Money Adoption in Sub-Saharan Africa

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Keywords: *digital literacy, financial inclusion, mobile money, financial access*

Introduction

The establishment of the United Nations Sustainable Development Goals (UN-SDGs) in 2015 for 2030 speaks to an all-inclusive world. Financial inclusion is prominent in six[1] of the UN-SDGs, therefore emphasizing the importance of bringing the "unbanked" into the formal financial sector with the aim to increase productivity and income, improve livelihood and poverty reduction. According to the World Bank Global Findex survey (2021), 40% of adults in sub-Saharan Africa, while 33% reported having a mobile money account. Sub-Saharan Africa experienced the most growth and reported the highest proportion of mobile money accounts in 2021 which has led to suggestions by scholars and international bodies that mobile money could bridge the financial inclusion gap and facilitate access to finance for the unbanked.

Reasons for conducting research

Despite notable success of mobile money adoption across other sub-Saharan African countries such as Tanzania, Rwanda and Kenya, the adoption of mobile money in the sub-region has not been uniform and remains low in other jurisdictions, resulting in low adoption. This study aims to investigate how digital literacy[2], financial inclusion, and financial services availability impact adoption of mobile money in sub-Saharan Africa. Further, Rogers (2003) Diffusion of Innovation (DOI) Theory states that innovation attributes explain 40-80 percent of why potential users adopt an innovation. Therefore, the study further incorporates mobile money attributes to assess the impact on adopting mobile money.

Main Contributions

Firstly, the study proposes a new framework for assessing the adoption of mobile money in sub-Saharan Africa, which could be tested in other developing countries and for other types of fintech. Secondly, the study incorporates mobile money attributes into the framework as a parameter to assess the impact of mobile money adoption. Thirdly, the study reports findings on the whole sample and groups countries according to the IMF Financial Development Index[3] (FDI) to compare findings from the entire sample with different levels of financial development. Fourthly, the study aims to contribute to literature on the determinants of mobile money adoption in sub-Saharan

[1]Goal 1(No Poverty), Goal 2 (Zero Hunger), Goal 5(Gender Equality), Goal 8(Decent work and economic growth, Goal 9 (Industry, Innovation, and Infrastructure), Goal 10 (Reduced inequalities)

[2] UNESCO defines digital literacy as "the ability to access, manage, understand, integrate, communicate, evaluate, and create information safely and appropriately through digital technologies for employment, decent jobs, and entrepreneurship. It includes competencies that are variously referred to as computer literacy, ICT literacy, information literacy, and media literacy" (Nancy *et.al*, 2018, pp 6)

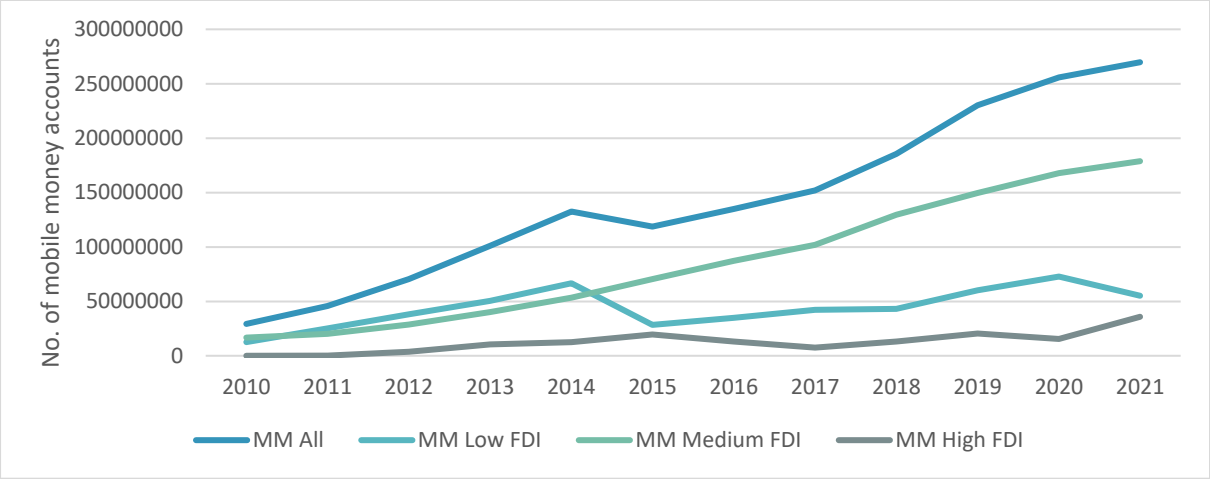
[3] The IMF Financial Development Index is a composite index that analyses how developed financial institutions and markets are in terms of their access, depth, and efficiency.

Africa. Lastly, on the policy level, the study seeks to provide a basis for policies to advance digital literacy and financial inclusion through mobile money advancement at regional and country level.

Key Findings

Figure 1 below shows movements of mobile money accounts across the entire sample and within the three county groups. Mobile money adoption is highest for medium financial development countries, followed by low financial developed countries and lowest for countries that have a relatively high financial development index.

Figure 1: Mobile money account adoption across 18 sub-Saharan Countries



Regression results

Regression results suggest that digital literacy and financial inclusion are positive and significant across the whole sample, low FDI, and medium FDI countries. As digital literacy and financial inclusion increase, the uptake of mobile money also increases. For relatively high FDI countries, results suggest that digital literacy is positive and significant. However, financial inclusion is negative and significant. Further, results show that for low FDI countries, financial access is negative and significant, suggesting that in areas where access to financial services is low mobile money has the potential to thrive. Financial access is not significant for medium and high FDI countries.

Addition of mobile money attributes results for financial inclusion resonate with the findings prior to addition of mobile money attributes. Digital literacy remains significant across the sample, for medium financially developed countries and for relatively high financially developed countries. However, digital literacy is not significant for low financial developed countries. Mobile money attributes are positive and significant across the sample and for low and medium FDI countries. However, they are not significant for countries with high FDI countries.

Conclusion

Results indicate a need for more research focused on mobile money attributes and highlighting in-country differences. Across the sub-continent digital literacy, financial inclusion and mobile money attributes are significant drivers for mobile money adoption. However, for relatively high FDI countries mobile money may not be the solution to increasing financial inclusion. The study's main limitation is data availability at country level, particularly on mobile money attributes as most countries do not report the data. This study groups countries according to the IMF Financial Development Index, further studies could focus on individual countries and isolate differences at the country level.

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Evaluating the Impact of Paid Family Leave Policies on Abortion and Fertility Rates: Evidence from Five U.S. States

Rory Allanson [a], *Dr. Agnese Romiti* [b], *Dr. Otto Lenhart* [c]

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Keywords: *Abortion, Fertility, U.S. States, Policy, Microeconomics*

Paid Family Leave (PFL) policies, which offer paid time off work at some level of wage replacement, are ubiquitous across the developed world (OECD, 2022). One notable exception however is the United States, which at the federal level only grants workers the right to take a short period of unpaid leave; this right is also only extended to a slight majority of private sector employees (Han et al., 2009). While approximately half of American women can access PFL through their employers, many miss out on the associated benefits, which include improved maternal and infant health outcomes (Bütikofer et al., 2021). In the absence of progress at the federal level, several states have launched their own PFL programmes, including California (2004), New Jersey (2009), Rhode Island (2014), New York (2018), Massachusetts (2019), and Washington (2019). An established literature has employed a suite of microeconomic methods to outline how these policies, particularly California's, have improved parental, infant, and economic outcomes (Bullinger, 2019).

However one avenue of the impact of PFL policies not yet well considered is their possible effect on family planning, an important and contentious topic in today's America. While Golightly and Meyerhofer (2022) demonstrate that California's PFL programme did increase fertility rates (particularly for older women), there are no present works considering the impact of these policies on abortion. As PFL policies aim to support the financial transition into parenthood, they may reduce the number of abortions induced by feelings of economic necessity, intuition which motivates our exercise. Moreover, considering that fertility and abortion have been previously shown to have an inverse relationship (Jones and Pineda-Torres, 2022), it appears natural to explore possible impacts on both, particularly as we can exploit recent methodological developments that may reinforce the findings of Golightly and Meyerhofer (2022).

To complete these objectives, we employ a 'Synthetic Difference-in-Differences' method that computationally constructs an approximation of each treated state in the absence of the policy, using a combination of untreated 'control' states where no PFL programme exists. By comparing the post-treatment outcomes of each treated state, where the policy was enacted, to those of their respective synthetic approximation, where it was not, we can identify the programme's causal impact by statistically evaluating any divergence between the two (see Figure 1). Drawing on data from the CDC, preliminary abortion results suggest that the effect of these programmes varied across states and age groups. In all five states PFL policies had no effect on abortion rates for younger women (<30), while for older women (30-44) an impact on abortion rates was observed for three states. In Massachusetts and Washington this impact was negative, decreasing abortion rates compared to the synthetic control, whereas

in New Jersey it was positive; results for New York and Rhode Island are largely inconclusive, while analysis of fertility rates is ongoing.

This exercise seeks to contribute to our understanding of the full contribution of PFL policies to welfare of mothers, employers, and society as a whole. It furthers our collective insight as to the significance of inclusive policies that offer important rights and benefits, especially with regards to a topic as important as family planning.

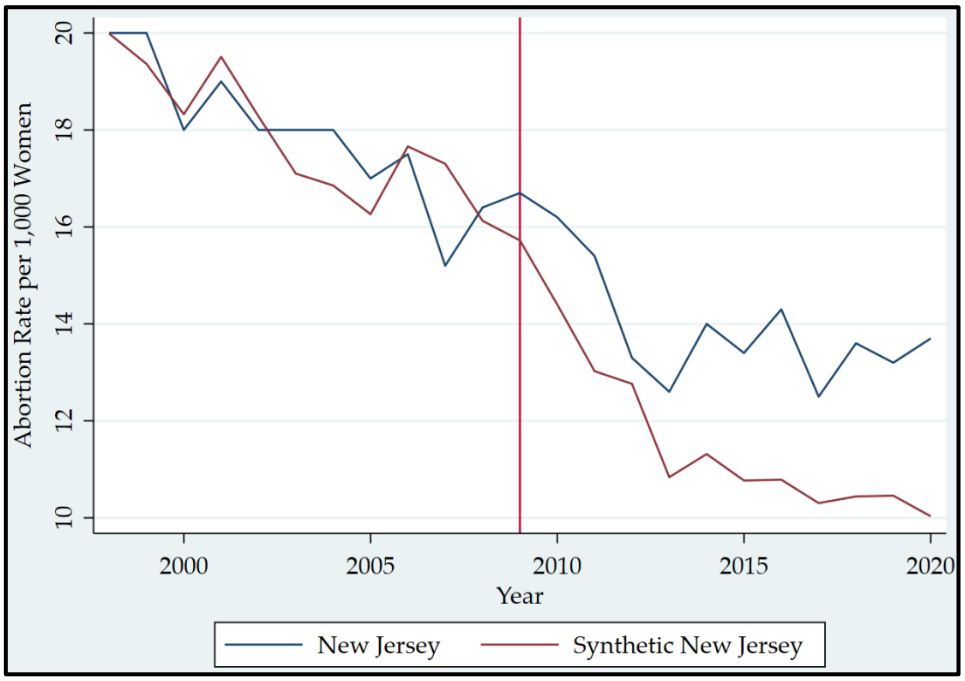

Figure 3 - Example divergence in abortion rates between treated state (New Jersey) and synthetic control following launch of PFL programme (2009).

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Urban Planning, Policy, and Technology; Urban District, City Building

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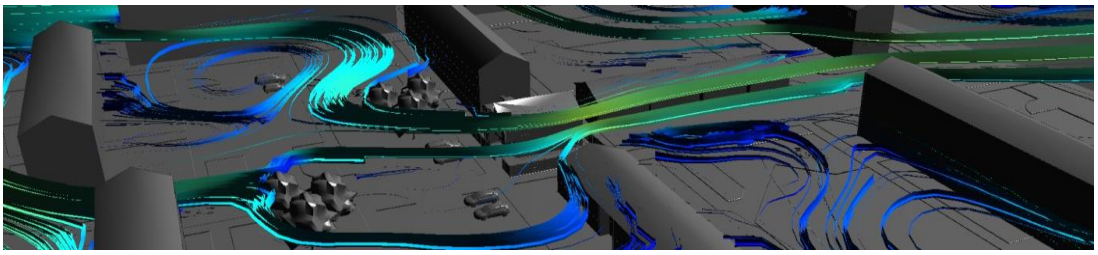
Keywords: *Digital Twin, Urban planning, Game Engines, 3D City models, Urban data visualisation*



Gaming and urban planning are two seemingly unrelated fields, but they actually have a lot in common and can benefit from each other in various ways.

On the one hand, gaming can be useful tool for urban planners to simulate and visualise different scenarios and designs for urban development. By using gaming engines and virtual environments, planners can create immersive and interactive simulations that allow them to test and evaluate various options, such as land use, transportation infrastructure, buildings design and community engagement. This can help planners to make more informed decision making and to involve all stakeholders (Government, Council, Community planners down to the citizens) in the planning process.

On the other hand, urban planning can also inspire and inform game developers in creating more realistic and engaging game worlds. Games that are set in urban environments, such as SimCity, City Skylines, GTA and Watchdogs, often incorporate elements of urban planning, such as zoning, traffic management, and public services, and traffic planning. By studying real life urban planning principles and practices, game developers can create more believable and compelling game worlds that reflect the complexities and challenges of urban life.

Moreover, gaming can also be used as a tool for public engagement and education in urban planning, as well as exploratory and creative analysis. By creating games that simulate the planning process and involve players in decision making, planners can raise awareness and interest in urban issues and encourage public participation in the planning process.

The goal of this research is to explore (or investigate into) the potential benefits of game engine in the development of city information models for modelling, simulation, and visualisation, and as tools for participatory urban planning and decision-making.

Without appropriate tools, resources, and knowledge to understand the evolution of cities and growth patterns and dynamism, it may be hard to visualize how current decisions or scenarios may affect the present and future environment. In addition, synergies may be difficult to establish due to the lack of common data structures of

various components of the urban environment, and the challenges of multi-stakeholder coordination in decision-making. And so having an enabling environment for city planning and visualising can encourage engagement, strengthen synergy, and improve participation in order to improve the understanding and quality of life in urban areas.

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The Correlates of Land Reform Dataset

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Keywords: Land Reform, Development, Dataset, Political Economy, Agrarian Reform.

Why have some developing states legislated land redistribution while others have not? To date, the land reform literature does not include cross-national studies identifying land reform episodes and trends across states and time. This is something the literature has not been able to address due to the lack of a large-N cross national dataset on land reform. This can be attributed to the lack of a consistent definition of land reform among scholars and policy makers and an overuse of case study analysis (Adams, Martin and Howell, 2001; Borras, 2006; Lipton, 2009; King, 2019 and Tai, 2022).

I have constructed an original, first of its kind dataset on land reform across former Asian, African, and Latin American colonies. I define land reform as government legislated land redistribution. Using a range of secondary sources including academic journals, government documents and IO reports, the dataset covers 101 states between 1945 and 2020, yielding 6,170 country-year observations.

The data identified 83 states that have introduced one or more land reform episodes and 18 states that have not legislated land reform in this period. In total, 121 land reform episodes have been carried out across the developing world. I also introduce a typology of land reform based on the ideological nature of each reform. Of the 121 land reform episodes, 87 can be categorised as market-orientated and 34 can be categorised as socialist.

This original dataset contributes to the literature in several ways: (1) being the first large-N cross national study of land reform across developing countries; (2) identifying the number and types of land reforms carried out; (3) developing a typology of land reform along the left-right ideological dimension; (4) identifying trends across time and region; and (5) outlining the duration of each reform episode.

This dataset will allow extensive research into political economy of land reform. Despite the importance of land reform, the literature lacks quantitative cross-country analysis of why reforms do and do not take place. There is a large body of literature on the causes of land reform but these tend to cover individual cases or a small number of cases (Lipton, 2009 and King, 2019).

To this end, after introducing the dataset, I probe a correlates of land reform identified in the dataset. Some of the factors I investigated were: the Correlates of War Formal Interstate Alliance Dataset which will establish formal alliances between scope countries and the USA, UK, France, USSR/Russia and China, data on arms transfers between scope countries and major world powers, membership of the G77 and the NAM, UN General Assembly voting patterns, IGO funding, regime type, political orientation of executives, colonial heritage(s) and the property rights protection index.

Furthermore, this dataset will allow researchers to evaluate the economic, social, and political consequences of land reform and its various types.

This dataset offers scholars and policy makers new opportunities to understand land reform. Researchers will be able to have a better understanding of variances of land reform across time and space. Scholars can also study the economic, social and political effects of land reform and the different typologies and by doing so opens up a new branch of development research. Once the various consequences have been outlined this will allow policy makers to pursue land redistribution legislation that brings about the most beneficial economic, social and political consequences for their state.

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Enhance LGBT Protection through UK Corporate Governance

Bryan Y. Wang[1]

Keywords: *LGBT, dignity, corporate governance, corporate social responsibility, due diligence*

LGBT people are entitled to equal dignity as others are entitled to in human community/society. To respect LGBT people's dignity, law plays a role in substantiating and protecting LGBT people's interests in all aspects of life, ensuring LGBT people's "full membership" in society. LGBT dignity protection has been developed, *inter alia*, in human rights law, law of employment and service provision, family law, immigration law and equality law in the UK jurisdiction. This thesis aims at introducing corporate law and governance to contribute to LGBT dignity protection in the UK. This thesis attempts to examine why LGBT dignity protection is a case in UK corporate activities and how corporate governance, including directors' duties, can be modified.

The focused problem in this thesis is that LGBT people can experience expressive harm in corporate service provision and employment areas in the UK. I contend that UK law of employment and service provision can provide "extra protection" on freely expressing/manifesting beliefs or opinions which involve objection to LGBT identities and interests, such as objection to same-sex life in Christianity beliefs. Individuals can be allowed by the law to go beyond "mere disapproval" and (intentionally or unintentionally) to deliver heterosexual and cisgender superiority implications to relevant LGBT people through service provision and employment areas. The expressions/manifestations can make LGBT people lesser human, but those speakers are not legally required with any responsibility for this LGBT expressive harm.

I contend that corporate directors and managers are not mandated with duties to address this expressive harm to LGBT people in the UK jurisdiction. In the law of employment and service provision, the UK proportionality approach is focused on merely dealing with material harm (e.g. discrimination) and does not provide much legal guidance on tackling expressive harm. More importantly, UK company law does not substantiate legal obligations for directors to tackle expressive harm to LGBT people in corporate activities. S.172 (1) of the Companies Act 2006 mandates directors to increase corporate profits for the ultimate purpose of shareholders' interests. While other stakeholders (e.g. employees, customers and people in the local communities) need to be considered, there is no LGBT dignity relevance in corporate directors' duties in UK company law.

To internalise LGBT dignity protection into directors' duties and governance, this thesis provides a theoretical approach – a new corporate purpose and a transformative corporate social responsibility (CSR) duty. I argue that human rights requirements are embodied in corporate governance, including shareholders' economic rights, employees and customers' rights, and gender equality and anti-discrimination, reflecting progressive adoption of the transformative CSR approach in law. The

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transformative CSR theoretical approach implies potentials of internalising LGBT dignity protection in directors' duties and corporate governance changes.

Being guided by the transformative CSR theoretical approach, this thesis proposes to embody Human Rights Due Diligence principle and create a LGBT due diligence process in the UK corporate governance legal framework. In this process, there is a central mandatory duty – LGBT due diligence duty – for directors to identify, prevent and mitigate expressions and manifestations which involve objections to LGBT interests in corporate activities, for the purpose of protecting LGBT dignity. To strengthen the central duty, this thesis also proposes to create two supportive mechanisms, including the mandatory LGBT due diligence reporting and the LGBT stakeholder engagement (soft-law).

The main findings are that the proposed LGBT due diligence process can weaken shareholder primacy but also strengthen directors' duties and corporate governance to enhance LGBT protection in corporate service provision and employment areas. Certainly, this thesis can introduce LGBT dignity relevance in corporate governance, nudging corporate governance to participate in LGBT dignity protection in the UK. Furthermore, the proposed management/governance change in corporate entities can set an example for the law of other organisations or entities, such as partnerships, financial sectors, charities and public authorities, to learn how to enhance LGBT dignity protection in the relevant service provision and employment areas. Nevertheless, the proposed LGBT due diligence process may not completely overturn shareholder primacy in UK corporate governance and company law. To have a more substantive LGBT-affirmative duty, this research implies a more radical change on corporate purpose in UK company law in the future.

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The Role of 'Resilience' in the Lives of Justice Experienced Women Living in the Community in Scotland

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Keywords: *gender, justice, resilience, neoliberalism*

Whilst the concept of 'resilience' is contested and has been critiqued for its underlying responsibilising discourse, its usage differs between disciplinary fields. Dominant definitions nevertheless conceptualise resilience as the ability to 'bounce back' after a stressful or traumatic event (Smith et al 2008). This neoliberal conceptualisation of 'resilience' as an individual characteristic detracts and distracts from the structural inequalities which cause oppression and subjugation for many, whilst undermining capacities for 'resilience'. This neoliberal viewpoint shifts responsibility from governments onto the individual.

This paper explains how this conceptualisation of 'resilience' not only serves to compound trauma experienced by women caught up in the justice system, but also how it simultaneously dismisses and diminishes the impact that trauma has had, charging them with 'fixing' themselves in an environment designed to increase their suffering. In contrast, this paper considers how the ecological perspective of 'resilience' could have more traction in this context, by recognising that responses to traumatic events are a result of 'complex interactions among person, event and environmental factors' rather than the sole outcome of individual capacities (Harvey 2003:3). Drawing further on concepts of recovery, I argue that traditional definitions of returning to 'normal' after a traumatic event elides the multi-faceted and complex nature of the lives of those who become entangled within the justice system and could be considered as a form of structural violence (Rylko-Bauer and Farmer 2016).

In so doing, this paper is based on a theoretical and empirical review of the literature into the impact of the intersections between mental health, poverty and stigma among justice experienced women and the role 'resilience' may play in this by examining the interplay between justice, gender and 'resilience'. This is to assess how an intersectional approach can challenge the attitudes and policies towards women within the criminal justice system and wider society, which tend to place blame at their feet and use diagnoses of mental ill health as a form of control. Ultimately, the aim of this research is to encourage a more realistic and human approach towards justice experienced women to reduce the damage done by the justice system and facilitate a more positive and supportive experience for the women.

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Long-term Care for the Elderly in East Asia After Confucianism: A Comparison of Japan, Singapore, and Thailand

Nitiwate Meesonk

Keywords: *Long-term care, Elderly, Confucianism, East Asia, Comparison study*

This comparative study concentrates on the current situation of the care models in East Asia, particularly on long-term care for the older persons influenced by Confucianism. Asian traditional care differs from other regions, which applies and develops Confucianism principles into the unique care system. Family is the priority in responsible care for the older member with the concept of filial piety that respects and is attentive to the elderly. However, this region is facing social disruption in the most critical global demographic changes with a massive growth of an ageing society and a dramatic decrease in population replacement. The targeting countries of the study confront the Confucianism transition coincidence significant similarities and differences issues between Japan, Singapore, and Thailand. The research's first aim is to shed new light on the Confucianism transition and the development of care regimes in East Asia. The second aim is to examine the political economy of long-term care and providers' obligations between the state, market, family, and community in the three countries. To what extent do we find diversity across the three nations, and how can changes be explained theoretically?

The study employs multiple qualitative methods, such as documentary research, to investigate and analyse secondary data from relevant policy documents. Moreover, the comparative research method will help to deliberate and explain cross-national variations. The investigation uses semi-structured interviews with policymakers and academic experts to understand complex policy processes and care models in-depth. The research outcomes will explain the Confucianism care model implemented as a social value and a typical care regime in East Asia. It also will highlight the correlations and oppositions related to long-term care policy from each country and among them. The discussion will explore prioritising care responsibility among care institutions that must share caring authority and resources to maintain social care sustainability.

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The Clash of Ethics and Economics in Inclusive Education

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Keywords: *Inclusive education, neoliberalism, teachers' views*

Inclusion is one of the dominant discourses in education policy on a global scale, as it is often recognised as a means of addressing the different needs of learners. However, it is a fraught issue when it comes to practising it. The role of teachers in promoting inclusive education is often acknowledged in policy papers, while their professional agency is increasingly neglected. Done and Murphy (2018) conceptualise this phenomenon as responsibilisation of teachers, which defines a mechanism that brings new responsibilities to teachers where their social and educational expertise are not sufficiently valued. Simply put, teachers are assigned the role of promoting inclusion in society through practising inclusive education and they are accountable for any failure in this process at the same time. This specific way of governing teachers signifies a neoliberal way of managing education.

This study aims to problematise the downside of this acknowledgement of teachers' role for inclusion in the framework of education policy in Scotland. With a critical policy analysis approach, four key policy papers related to inclusive education have been examined to understand how a neoliberal view of education permeates into education through policy papers. In addition to this, empirical data has been gathered through interviews with 12 primary school teachers to investigate the impact of neoliberal discourses on teachers' views about inclusive education.

The study is likely to have implications for the field of inclusive education as it examines teachers' views about inclusive education from a critical realist perspective which aims to reveal deeper mechanisms in effect. In addition, it may contribute to struggles for making teachers active agents of a more inclusive society building and to the resistance to neo-liberalisation of education.

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Turnover Intention among Female Engineers: A Field Theory Perspective

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Keywords: *Turnover, Female Engineers, Lewin's Field Theory, Role Theory*

Engineering is commonly related to men's work, with 80% of the engineering workforce being made up of men. However, the increasing involvement of women in this industry has demonstrated that it is not necessarily a profession exclusively for men, and that women are equally capable of being successful engineers. Despite this progress, the industry that is always associated with masculine identity can still be a challenging environment for female engineers. Due to women are commonly holding multiple roles (e.g., at work, home and community), consequently, role stress and role conflicts may arise and influence their withdrawal cognitions.

Basing the idea on role theory, which posits that female engineers occupy multiple roles in various settings, the objective of this research to explore the forces experienced by women engineers both within and outside of the organization, which may influence their career decisions. The interest of this research lies in understanding the driving and restraining forces behind employee turnover among female engineers, using Lewin's field theory as a theoretical framework. This theory posits that behaviour is not solely determined by one factor, but rather by the interaction between two types of forces that are driving forces that push individuals towards a particular action, and restraining forces that inhibit or resist such action. By applying this framework to the context of female engineers' turnover, this research aims to contribute to the turnover literature by identifying the key factors that drive their decision to leave or stay in their organizations, as well as the barriers that prevent them from leaving.

To explore this issue more detail, focus group discussion is employed to allow a more dynamic and interactive discussion among the female engineers, resulting in rich and in-depth data. Data is analysed through thematic analysis that offered more exploration of the various forces of turnover experienced by women engineers. The outcomes of this research will likely help organizations to develop more effective strategies to attract, retain, and promote female engineers, thereby enhancing gender diversity and equity in STEM fields.

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Impactful Entrepreneurship and Innovation

‘Where’d you pick that up?’: Meta-Skills and the Youth Transition

Anya Kaufman

Keywords: *Youth Transition, Social Reproduction Theory, Gender, Socio-Economic Status*

Young people are facing a youth transition that is increasingly complex, non-linear and full of risky decisions that require a sophisticated skill set in order to successfully navigate. Meta-skills have been identified by Skills Development Scotland as important for work in the 21st century as they are skills used for learning and adapting to new situations. The skills include concepts such as communication, teamwork and critical thinking, all of which are important from the transition from secondary school to work, further or higher education.

Despite their importance, there is limited research on how these skills are acquired or developed outside of specific settings such as university. Additionally, meta-skills are typically framed within the context of employability, despite their application to day-to-day life which suggests at a disconnect between reality and meta-skills discourse. Social Reproduction Theory, which attempts to understand the relationship between productive and reproductive labour in a capitalist society through discussion of systematic oppression, is used in my research to better understand how meta-skills are subject to the logic of a capitalist society.

By interviewing thirty young people, aged 16 – 18, living in Clackmannanshire I collected data relating to how they gained, developed, used and valued meta-skills. Currently, I am in the process of analysing that data using a Social Reproduction Theory lens to better understand how various factors relating to oppression, such a socio-economic class and gender, impact how meta-skills are gained and valued by young people. So far, my research indicates that young people gain meta-skills in either formal or informal settings which has a significant impact on how they value their skills. Young people who took part in more structured and formal meta-skill building activities, such as a part-time job or after-school sport, were easily able to identify their meta-skills and how they would be useful in the future. In contrast, the young people who gained their meta-skills in an unstructured, informal setting, such as babysitting or a hobby, were far less likely recognise that they had gained meta-skills and seemed sceptical that their skills were as valuable as their peers. This difference could increase the difficulty of these young people’s youth transitions due the importance of being able to identify and communicate meta-skills in applications for further study or work. Additionally, young people who do not understand how to use meta-skills in non-work context may then struggle when they find themselves responsible for their social reproduction if they leave their childhood home.

By using a Social Reproduction Theory lens to better understand the relationship between young and their meta-skills, my research suggests the ways in which socio-economic and gendered norms influence the youth transition. This knowledge could then be used by policy makers and other relevant stakeholders to develop solutions that can help young people to better manage their youth transitions.

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Entrepreneurial Ecosystems: Knowledge Creation, Sharing and Learning

Bohdana Schwendtner

Keywords: Entrepreneurial Ecosystem, Microfoundations, Entrepreneurial Activity, Entrepreneurial Behaviour, Entrepreneurial Capital, Context.

My research is focusing on analysing the Entrepreneurial Ecosystem from the micro-level perspective, specifically focusing on entrepreneurs and their behaviour leading to entrepreneurial activities.

The purpose of my research is to help develop a more holistic and nuanced understanding of the mechanisms and processes that drive individual-level behaviour and decision-making in the context of entrepreneurial activities and provide valuable insights for policymakers and practitioners who aim to support and promote entrepreneurial activities to ultimately foster the growth of more vibrant and inclusive entrepreneurial ecosystems.

The research addresses the increasingly important role of culture, resources systems, rules, and the institutional environment which have the power to create entrepreneurial synergies. Local and regional authorities also play an existential role in ensuring the entrepreneurial drive continues to emerge and flourish. These elements will help navigate the main research focus of understanding the role of microfoundation within the EE which will be analysed in depth.

Additionally, the research identifies several factors used in explaining how microfoundation processes are enabled and constrained by agency and structure. The flow of resources and information is also analysed and applied to the microfoundation perspective to provide rich insights into the dynamics of the field and its impact.

“Coleman’s bathtub” (Figure 1 below) visualises my research goal best. The aim is to understand the processes which happen between the macro and micro level of the model as a whole rather than analyse the components of it in isolation which has been undertaken by scholars over the years.

The following research question was formulated and tested for their significance and contribution.

How do microfoundations (individual actions and behaviors of entrepreneurs and other actors) within an entrepreneurial ecosystem contribute to the overall success and sustainability of the EE?

The sub-questions are:

1. What type of resources do entrepreneurs utilise within the EE, and how do these resources contribute to the development and success of entrepreneurial activities?

2. How do these resources and the entrepreneur's abilities impact entrepreneurial activity, and how can these be effectively leveraged within the EE?

3. Finally, how do the entrepreneurial activities feed back into the ecosystem and inform development of more effective policies and interventions to support entrepreneurship?

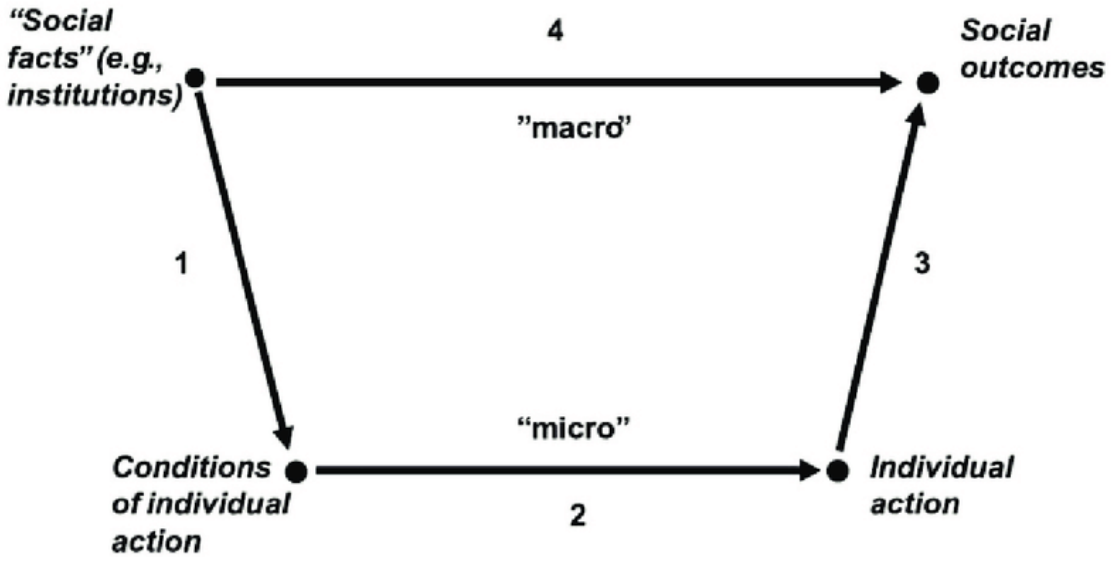

Figure 4: Colemans bathtub model. Source: (Felin, Foss and Ployhart, 2015)

Methodology

The proposed methodology for this research will be an ethnographic field study. The field study will be conducted in Glasgow, Scotland with Glasgow City Innovation District (GCID) as the main case study of this paper. The goal is to understand the micro-level processes within the Glaswegian Ecosystem. Through the adoption of interviews shared or individual experiences will be unravelled to reveal details of the ways how the ecosystem impacts their actions and behaviour and how the individuals see themselves fit into the system, the way them communicate and behave.

Contribution

With this paper I am to inform policy and interventions to create a deeper understanding of the motivations, decision-making processes, and behaviours of individual entrepreneurs. This paper will also contribute to the wider understanding of the resources necessary to aid the entrepreneur in developing abilities and engaging in entrepreneurial activity.

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A Novel and Practical Care Process Framework to Inform Model of Care Development

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Keywords: *Care process framework, Model of care, Team-based care*

Breaking free of pre-existing assumptions to achieve genuine transformative change in health care delivery remains challenging. There is a need to shift from historical approaches of model of care development to one that is more responsive, flexible, and collaborative - where patient and population health needs drive care model development and align better to a range of scopes of practices and staff/ skill mix. There is also a lack of practical frameworks and explicit designs of studies in the health sciences literature that inspire leaders to think differently.

For more than a decade, healthcare experts across the globe have been warning about the looming health human resource crisis. The COVID-19 pandemic hit a health system already facing multiple challenges: an overworked workforce struggling to keep pace with service expansions in healthcare, magnified by an ageing staff and growing percentage of less experienced clinicians.

This paper presents a novel and practical Care Process Framework (CPF) tested with healthcare teams across five communities in British Columbia, Canada, to introduce leaders to a novel and practical approach to care model development. The study's primary goal was to determine if the framework was replicable across differing population care needs but also to see if the framework could uncover and overcome pre-existing assumptions about what care could look like, how it could be approached and delivered differently, and by which professions/ care team members.

Having a practical framework that maps out the care needs from the patient's perspective, (not from the service, professional or provider perspective) and seeing how the patient's care needs can shift throughout their care journey identified new thinking and approaches to healthcare delivery and by whom. To capture this journey, first, a care process graphic was created by engaging with the leaders and clinicians (Subject Matter Experts (SMEs)) and similar care activities were identified and grouped together. (See Figure 1: Macro Care Process for Integrated Primary and Community Care).

Also, at the time of this study, a modified Cognitive Task Analysis (CTA) known as a Rapid Task Analysis (RTA) coined by Goffredson and Mosher in their book *Innovative Performance Support*, was an approach being used within the health authority to build education and learning and performance support resources.[1] This aligns with the Militello and Hoffman depiction that CTA methods not only help focus on better understanding of the cognitive demands of a task but also on the knowledge and strategies underlying performance.[2] This finding supports Swaby et al that CTAs (Cognitive Task Analysis) have untapped potential in the health sciences research.[3]

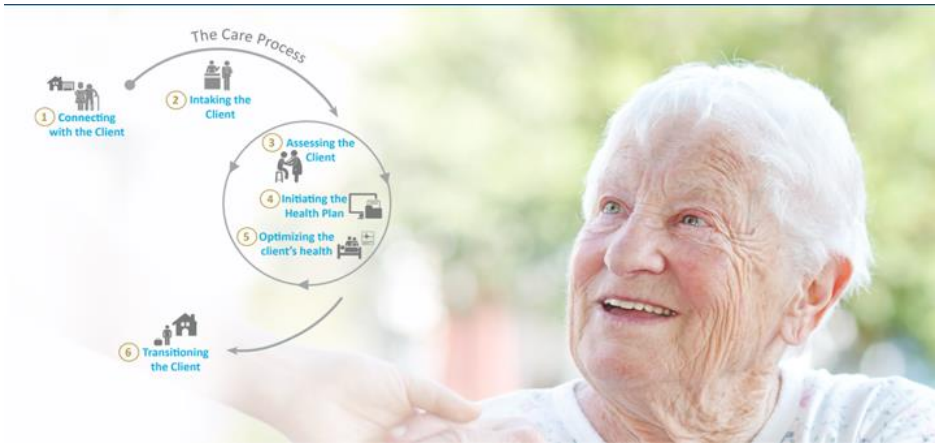

Figure 1: Macro Care Process for Integrated Primary and Community Care

Building a care process first and then mapping the care activities using the RTA with teams illuminated a valuable and deeper understanding of the care being provided for a typical patient accessing health services. This approach can also be used to build efficiencies in orienting less experienced clinicians by capturing expert and tacit knowledge and decision-making providing the novel design element Graham et al states is missing from the health and implementation sciences literature.[4] (See Table 1: Sample of the Rapid Task Analysis (RTA) and Audience Analysis).

Table 1: Sample of the Rapid Task Analysis (RTA) and Audience Analysis

Care Activities (Tasks and/or Functions)	Physician	Nurse Practitioner (NP)	Registered Nurse	Registered Psychiatric Nurse	Licensed Practice Nurse	Community Health Worker	Pharmacist	Pharmacist Technician	Psychologist	Registered Clinical Social Worker	Registered Social Worker	Audiologist	Speech & Language Pathologist	Registered Dietitian	Respiratory Therapist	Occupational Therapist	Physical Therapist	Rehabilitation Assistant/Activity Worker	Clinical & Medical Office Assistant	Medical Office Assistant	Administrative Assistant	Booking Clerk/ Interdisciplinary Team Clerk/ Central Team Clerk	Scheduler	Community Paramedic CP
1. Connecting (with) the client																								
1.1. Connect clients in need of support in the community (connection point)																								
1.2. Greet client when presenting for services (access point)																								
1.3. Initiate handover to care team																								
2. In-taking the Client																								
2.1. Determine urgency of client's need																								
2.2. Register the Client																								
2.3. Prepare health record as appropriate																								
2.4. Determine most appropriate intake clinician																								
2.5. Conduct intake																								
• Select and conduct suitable screening (e.g. immunization history, swallowing, malnutrition, GI system, home safety, cognition, suicide, abuse, neglect)																								
2.6. Identify resources for client																								

In scope of practice
Fit for both Primary Care Home AND Integrated Community Services teams
College limits/conditions
Out of Scope
Task includes range of options

The results showed the framework was replicable across differing population care needs and services and informed new care model development by identifying new approaches to optimize the scopes of practice and align staff that are more effective/ have the right skill mix given the context of care. The framework also captured expert tacit knowledge and decision-making to build learning and organizational capacity given our current workforce challenges. For operational leaders and government agencies, the use of the care process framework may influence a shift in historical

approaches to care model development that better aligns health and human resources capacity to population health and service needs.

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The Impact of Stock Market Crises on Local and Global Safe Haven Assets; Evidence from Global Financial Crises (GFC) 2008, COVID-19 pandemic and Russia and Ukraine Conflict 2022

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Keywords: *Global Financial Crises (GFC), COVID-19 pandemic, Russia and Ukraine conflict, GARCH models, hedging effectiveness*

Our study examines the valuable assets and stock performance as a hedge during 3 financial markets crises that include Global Financial Crises (GFC) in 2008, the COVID-19 pandemic, and Russia and Ukraine Conflict in 2022. Hedge assets are those that maintain their value and prices even after having financial stress in external markets or the world for example COVID-19. Furthermore, this study identified how much volatility exists in the relationship between stock-market Indices and precious assets. We used different methods to test the efficiency of assets and how much secure the asset is for investors to invest their money even during the financial market crisis.

To cover the methodological gap in previous literature which could not clearly identified to check the hedging effectiveness of assets, our study used the Portfolio method, HE formula method, GARCH-in-Mean method, OLS method, and different conditional volatility models which is also an extension of the study by Buyukkara, Kucukozmen, & Uysal, 2022. These methods are used to identify the volatility of the asset during the financial market crisis.

To cover the theoretical gap where previous literature employed only 2 assets in a portfolio, which is a violation of the Portfolio Theory by Harry Markowitz in 1952, our study used Portfolios of 16 assets, 10 assets, and 6 assets. Additionally, our study identified the knowledge gap in previous studies which confirmed the contradictory results that created confusion. Besides, by utilizing different techniques in the study, the results also change which is also confirmed by the study of Jahja & Loebiantoro, 2018. To cover this knowledge gap, our study used 4 Hedging Effectiveness (HE) Techniques, Univariate and Multivariate GARCH models, and Volatility Index (control variable) to analyze the stress level in the financial market. This is an extension of the study by Dutta, Das, Jana, & Vo, 2020.

Variables of our study are six safe-haven assets (Bitcoin, Silver, Gold, US T-bill, US T-bonds, and VIX) and ten stock market Indices which include USA (S&P 500), China (Shanghai Stock Exchange SSE), Germany (DAX Index), UK (FTSE100), France (CAC40), Pakistan (KSE), Russia (MOEX) and Ukraine (PFTS), Switzerland's blue-chip stock market index (Swiss Market Index - SMI), and a control variable ‘’Volatility Index (VIX)’’.

Using univariate GARCH and multi-variate GARCH models on daily data from January 1990 to May 2022 of all variables, our results discovered that were the only two assets that maintained their value even during all three financial crises (GFC 2008, COVID-19, and Russia and Ukraine Crises 2022). We also confirmed these results by

employing 4 different techniques to test the hedging properties of all assets and stocks. Moreover, the study findings confirmed that by adding both silver and gold in a portfolio mixed with stocks, the volatility of the portfolio has decreased while the portfolio return has increased.

The practical implication of our research provides useful guidance for Investors, Financial managers, Funds Managers, risk managers, and Policymakers. Investors can utilize the findings of our study before investing their huge amounts of funds into stocks or assets so that they can diversify the upcoming risk. For the policymakers, as reported in our study that financial assets have properties to change over time and monitor the financial markets to improve their policy decisions. Our study suggested that financial and risk managers should develop smart and effective investment plans, strategies, and policies to safeguard their assets during volatile market conditions

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A Framework for Building Superior Portfolios Using Topological Data Analysis and Hierarchical Risk Parity

Jai Geelal

This research article introduces a cutting-edge framework for constructing superior investment portfolios by combining Topological Data Analysis (TDA) and Hierarchical Risk Parity (HRP). The study addresses the limitations in traditional portfolio optimization techniques, such as the Markowitz mean-variance framework, by capitalizing on the strengths of TDA in uncovering complex patterns and dependencies among financial assets and HRP in providing a more robust asset allocation strategy. The proposed framework aims to improve portfolio diversification, mitigate market shocks, and enhance risk-adjusted returns for investors. Traditional portfolio optimization techniques, including the mean-variance approach, are often criticized for their reliance on restrictive assumptions, such as normally distributed returns and linear relationships among assets. This may result in suboptimal portfolio allocations and an underestimation of the true risks involved. To overcome these limitations, our framework utilizes TDA to preprocess and transform financial data. TDA, a relatively new branch of applied mathematics, has shown promise in revealing hidden structures and non-linear relationships within complex datasets, making it a valuable tool for financial applications.

The first step of our framework involves preprocessing and transforming financial data using TDA techniques. This includes applying persistent homology to identify topological features and Mapper algorithms to construct network representations of the financial markets. The resulting topological information provides a more accurate representation of the underlying asset relationships and their respective risk profiles, facilitating a more informed allocation strategy. The second step involves applying HRP for hierarchical clustering and risk allocation. HRP, an innovative portfolio construction technique, addresses the limitations of traditional methods by incorporating hierarchical clustering of assets based on their correlations and the subsequent risk allocation according to the marginal risk contribution of each cluster. This approach allows for a more balanced and diversified portfolio, minimizing concentration risks and enhancing stability during market turbulence. The third step assesses the out-of-sample performance of the optimized portfolios. The framework is applied to historical financial data of various asset classes, including equities, fixed income, commodities, and alternative investments. The performance of the TDA-HRP optimized portfolios is compared against traditional portfolio optimization methods, such as the mean-variance framework and equal-weighted allocations.

Our findings demonstrate that the proposed TDA-HRP framework generates superior risk-adjusted returns, enhances portfolio diversification, and mitigates the impact of market shocks. The results highlight the potential benefits of combining TDA and HRP for investors seeking to improve their investment decision-making process and achieve better risk-adjusted performance. This study contributes to the existing literature by offering a novel approach for portfolio construction and advancing the understanding of the potential synergies between TDA and HRP in financial applications. The proposed framework presents a practical and innovative alternative for investors and portfolio managers, with potential implications for risk management, asset allocation, and investment strategy design.

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Does Variance Risk Premium Predict Bitcoin Return?

Wafa Alwafi

The present study evaluates whether the variance risk premium could be used to forecast Bitcoin returns. Bollerslev (2014) defines the variance risk premium as the difference between the current measure of return variation and the market's future expectation of return variation. In one sense, the market's expectation of future return variation is implied volatility. On the other hand, the current return variation measure represents the asset's implied volatility (Bollerslev, 2014; Kambouroudis, 2016). The variance risk premium is critical in assessing the leverage effect of investment. Hu, Jacobs, and Seo (2022) found a positive link between the variance risk premium and the conditional covariance between market return and its variance.The variance risk premium provides useful information that helps investors understand the risk associated with specific investments (Hu, Jacobs & Seo, 2022). Regarding the importance of the variance risk premium as a proxy for Bitcoin's future returns, as it represents a measure of aggregate risk aversion. The results validate the predictive relationship between Bitcoin's future returns and the historical variance risk premium. They also validate that this relation will hold true for medium-term forecasting. Our limitation for the study lies in the fact that we ignored investors' behaviour and perceptions of risk that could be affected by any information provided by the derivatives market. This behaviour will impact the performance of investment decisions and future returns.

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Understanding the Impact of Cognitive Styles on Scenario Planning

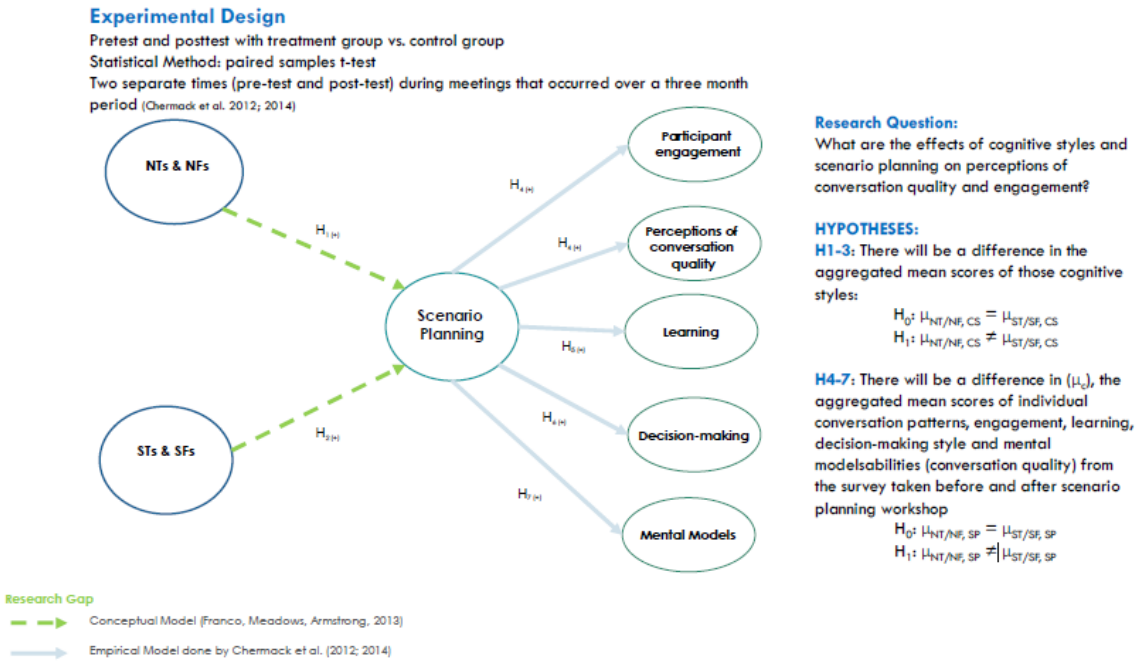
Harry Patria

Keywords: *Scenario planning, Scenario planning process, Individual differences, Cognitive styles, Team cognition*

This study aims to investigate the conceptual relationships between cognitive diversity and cognitive outcomes in scenario planning. Earlier studies heavily involved laboratory experiments with students, whereas other studies merely investigated conceptual analysis, both of which concurrently resulted in a lack of empirical evidence using decision-makers in the context of a business environment.

A literature review and frameworks are discussed in carried out to investigate intellectual roots and cognitive style comparisons in understanding the impact of individual differences on mental models, strategic conversation, learning, and the scenario process, thereby cognitive style seems more promising to explain the heterogeneity of the team than traditional socioeconomic measures such as age or educational background.

The study also suggests propositions and scenario process outcomes that could be empirically measured from individual participants with a standard t-test to compare the group behavior gathered using pre-and post-scenario planning workshops. Limitations and recommendations are discussed in depth for improving this research in future studies.



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Healthier Humanity

NoFap Communities and Desires of Disconnection

Andy Porter

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Keywords: *Disconnection, network experience, masculinity, NoFap, pornography*

Studies of internet-based anti-masturbation communities and movements are a rapidly growing area of scholarship. These communities have been examined for their users' complex constructions of masculinity (Taylor and Jackson 2018), paradoxical masculine identifications (Hartmann 2021), and relationships both with and against other male-dominated internet-based communities, such as incel and manosphere groups (Johanssen 2022). The real-world outputs of these latter communities are often misogynistic and violent, motivated by forms of gender-based hate. Anti-masturbation (or "NoFap") are positioned as tangential to incel and manosphere groups. Their real-world outputs are less visible, and often include more nuanced, complex, and potentially problematic themes of relationships between genders. However, little attention has been paid to these communities' reactions to, and motivations for, ceasing pornography consumption as a form of media experience. Working under the framework of online pornography consumption as an element of the "network experience" (Holt 2021), one that is itself inherently sexual and capable of influencing a user's own desires, this paper aims to investigate users' responses to the network experience through their abstinence from pornography consumption. This presentation comprises a thematic discourse analysis of comments relating to elements of network experience across five of the most popular anti-masturbation communities on Reddit, including r/NoFap and r/SemenRetention. Data reveals users seek to disconnect from digital society and elements of the network experience as a means self-governance and in pursuit of an imagined "realness" both in themselves and in their interactions with others, specifically in their gendered relations. Using these examples, this paper will further contextualise anti-masturbation communities against similar movements which describes users' self-governance for the purposes of healthier individuals and societies, though often with unintended side effects. Findings from this research open up new understandings of users' experiences of involvement in digital society, their gendered relations and ideological motivations. Such understandings allow for the reduction of gender-based hate and violence in both online and offline contexts, and the promotion of healthier individuals, communities and societies.

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Prescribing for Older People with Sensory Impairment: A Study with Independent Prescribers in Primary Care

Brenda Morrison [a], *Eugene Asante* [a], *Dr. Marilyn Lennon* [a], *Professor Margaret Watson* [a]

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Keywords: Prescribing; medicines management; hearing impaired; vision impaired; deaf-blind

Background: People with sensory impairment are at increased risk from their medicines(1). Older people (≥65) with hearing, visual, and dual impairment are more likely to have multiple-morbidities (multiple medical conditions), live alone, and use one or more medicines (polypharmacy) on a regular basis than older people without impairment(2). Community-dwelling older people with sensory impairment are at increased risk of non-adherence and inappropriate monitoring(3). The prescriber's contribution is critical for a more person-centred approach to the management of multi-morbidity in order to optimise medicines use and improve health outcomes for older people with sensory impairment, particularly those with polypharmacy needs.

Aims: This study aims to explore independent prescribers' awareness of medicine-related challenges of older people with sensory impairment and identify the influences on prescribing behaviours for these specific patient populations in primary care. This will facilitate development of evidence-based guidelines to promote the safe and effective use of medicines ensuring people obtain the best possible outcomes from their medicines.

Methods: Searches of the following electronic databases were carried out from January 2012 to April 2023: MedLine; Embase; Cochrane Library; and CINAHL. Grey literature resources and social media-enabled research were also searched. The results will be reported in full in a Preferred Reporting Items for Systematic reviews and Meta-Analysis extension for Scoping Reviews (PRISMA-ScR) flow diagram(4).

Findings: A total of 3,590 titles/abstracts were identified for screening from database searching with five full text studies having met inclusion eligibility. Studies explored the effectiveness of sensory environments in healthcare settings (n=1), interventions for improving adherence to therapies used in the treatment of Glaucoma (an eye condition, where the optic nerve that connects the eye with the brain, becomes damaged) and vision disorders, generally (n= 3), and real-time speech-to-text captioning to improve informed consent of hearing-impaired patients (n=1). No studies meeting the inclusion criteria were found to evaluate whether and how independent prescribers modify their prescribing behaviours for older people (≥65) with sensory impairment.

Conclusions: A follow up interview study has been planned to understand prescribing behaviours of independent prescribers in primary care and to explore the type of interventions that could support medicines optimisation for older people with sensory impairment and polypharmacy. Semi-structured interviews with up to 20 participants will be undertaken in June 2023 and will be informed by the COM-B model of behaviour(5). Participants will be purposively sampled to allow for variation in personal characteristics, practice/organisational setting and by geographical location.

Participants, comprising five independent prescribers from each of the following groups: GPs; Nurses; Pharmacists; and other Health Care Practitioners will be Independent Prescribers working in primary care across a range of settings and who provide care to older people (≥65) with sensory impairments, in the UK. A total of 10% of included results will be independently validated by two reviewers at each step of study screening, data extraction and data coding. The interview study will be reported using the Consolidated Criteria for Reporting Qualitative Studies (COREQ)[6]. In the UK, there are currently no national evidence-based guidelines or standards for prescribing for older people with sensory impairments. Development and evaluation of evidence-based systems and processes are needed to promote the safe and effective use of medicines by these specific patient populations.

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'Next Generation Lipid Nanoparticle Therapeutic Stability Evaluation'

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Keywords: *Therapeutics, Drug Delivery, Lipid Nanoparticle, Analysis*

Currently there is an unmet clinical need for therapeutics against treatment-resistant diseases and degenerative medical conditions. Oligonucleotides (oligos) are promising candidates to meet clinical needs. Oligos are synthetic strands of DNA/RNA molecules, which can be used to inhibit gene expression within cells and cease the onset/progression of medical conditions. Unfortunately, oligo drug candidates have a low translation rate in completing clinical trials. With the use of a drug delivery platform, oligo drugs have a higher likelihood of success in clinical trials. Lipid nanoparticles (LNPs) have shown the greatest potential for use as a drug delivery platform for oligo therapeutics. During formulation, the selection of four lipid components self-assemble around the oligo and encapsulate the drug within in the centre of lipid nanoparticle.

LNP-drug formulation methods have proved successful as within the previous five years, with the Food and Drug Administration approving oligo siRNA Onpattro® therapeutic, and mRNA Spikevax® and Comirnaty® LNP vaccinations [1]. The design and manufacture of oligo-LNPs contribute to their associated particle size, homogeneity, surface charge, oligo loading and their physical stability. These oligo-LNP chemical critical quality attributes, impact the therapeutic action and biological performance of the oligo-LNP candidates [2]. During the early development phase, oligo-LNP formulation stability must be evaluated to screen for potential therapeutic candidates to proceed the optimal oligo-LNP selection using high resolution techniques.

The aim of this study was to assess the stability of oligo-LNP formulations under various storage conditions.

PolyA (oligo) was encapsulated in LNPs composed of 1,2-dioleoyl-3-trimethylammonium-propane:cholesterol: 1,2-distearoyl-sn-glycero-3-phosphocholine: 1,2-dimyristoyl-rac-glycero-3-methoxypolyethylene glycol-2000 (DOTAP:CHOL:DSPC:DMG-PEG2000). PolyA DOTAP-LNPs were formulated at 50:38.5:10:1.5 molar percentage ratio using microfluidics, and PolyA DOTAP-LNPs were purified via dialysis against phosphate buffered saline (pH7.4). Resultant formulations were stored at 4 °C, and at – 80 °C with and without the addition of a cryoprotectant (20 % Sucrose, w/v). Particle size, polydispersity and surface charge were evaluated using the Zetsaizer. Nanoparticle Tracking Analysis (NTA) was used as an orthogonal method for measuring LNP size and corresponding particle concentration, and the Ribogreen assay was used to measure the loading of PolyA within LNPs.

Optimal storage conditions for PolyA DOTAP-LNPs were determined as 4 °C (refrigeration), followed by – 80 °C (with cryoprotectant) and – 80 °C without a cryoprotectant. As both particle size and polydispersity increased storage at -80 °C with and without- the addition of a cryoprotectant. As the formulation was analysed specifically for PolyA drug and DOTAP lipid, any changes in formulation would require analysis of the new LNP formulation.

We successfully analysed the stability of PolyA DOTAP-LNPs in formulation buffer with and without the addition of a cryoprotectant. Future work will consider the evaluation of LNPs with different lipid compositions and development of high-resolution analytical separation methods for the evaluation of LNPs in formulation buffer.

The research being conducted contributes towards the theme of 'Healthier Humanity' as gene therapies within clinical development required to improve the health of individuals, communities, and societies. Our understanding of LNP formulations will deepen as connections between manufacture process and particle design, and critical quality attributes can be drawn.

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User-centred Design of Digital Products and Services for Supporting Older Adults with Sensory Impairment in Their Medicine Management

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Keywords: *Medication Management, Older Adults, Sensory Impairment, Assistive Technology, User-centred Design*

Background

The proportion of older people (60 years or older) in the world is expected to triple by 2050 (Desa, 2019). According to the Health Survey for England (2013), over 50% of people who were 65 years or older were using a minimum of three medicines, and more than one-third of people who were 75 years or older were taking a minimum of six medicines. This increases the likelihood of experiencing harmful effects and interactions due to the medications. Older people's quality of life and function is significantly affected by a decline in hearing and vision quality (Crews and Campbell, 2004). Older a adults who suffer from visual impairment have expressed challenges in distinguishing between various tablets, reading information provided on instruction leaflets, and identifying expiry dates (Alhusein et al., 2018).

There are a variety of assistive technologies, such as automatic pill dispensers, braille translators and glow mats, among many others, for medication management in older adults with visual and/or hearing impairment. The main goal of these assistive tools is to promote medication adherence and simplify complex medication regimens. The success of these digital tools largely depends on the appropriate assessment of the individual's current needs and capabilities and selecting the right strategies and tools to help them to effectively manage their medications in ways that suit them.

It is unclear however if and how older adults with visual and/or hearing impairment are currently assessed in terms of how effectively they can manage their medications. It appears to be that there is also a lack of awareness about the variety of assistive devices available resulting in the wrong devices for the wrong purposes.

Aims and Objectives

To explore health and social care professionals' views and/or experiences of formal or informal assessment and/or provision of assistive devices to community-dwelling older adults with visual and/or hearing impairment for medication management.

To design and develop a digital solution to aid in the appropriate assessment and/or provision of assistive devices to community-dwelling older adults with visual and/or hearing impairment for medication management.

Methods

The aims and objectives of the research will be achieved through the following methods.

Interviews: Qualitative online semi structured interviews with health and social care professionals to understand current procedures and practices in the assessment and provision of digital tools to older adults with visual and/or hearing impairment.

Scoping Review: A scoping literature review on the reported assessment and provision of assistive devices to understand the existing gaps in the available literature.

User-centred design: A user-centred design approach will be employed to ensure that the final solution is tailored to the specific needs and requirements of the users (older adults with visual and/or hearing impairment and/or health and social care workers).

Impact

The findings of this research have the potential to significantly impact the health and well-being of older adults with visual and/or hearing impairment who are managing complex medication regimens. The development of a digital solution could improve the accuracy and efficiency of assessments, and ultimately lead to the provision of more appropriate and effective assistive devices. This research has the potential to improve medication adherence, increase independence and quality of life, and reduce healthcare costs associated with medication errors and non-adherence.

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Sustainable Scheme for Children's Access to Corrective Spectacles in Ghana

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***Keywords**: Spectacles, Children, Scheme, Refractive error, Ghana*

An estimated one (1) billion people across the globe have various forms of vision impairment that could have been prevented or is yet to be addressed (1). Out of this number, 123.7 million people have been estimated to have a form of vision impairment called uncorrected refractive errors (URE) making it (URE) the major cause of visual impairment in low-income countries. Furthermore, it has been reported that a minimum of 19 million children below the age of 15 years of age suffer from vision impairment (2). Studies have shown that the presence of uncorrected refractive errors in children can negatively affect their development, education, future employment opportunities and quality of life (3).

It is generally agreed that spectacles are the simplest and most inexpensive option to eliminate the problem of URE in most parts of the world. Cost has been identified as a major barrier to the accessibility of spectacles across the world with data in some low-middle income countries showing few people are willing to pay for spectacles (4). It has been proposed that uncorrected refractive errors can best be eliminated globally especially in low-income countries through the development of a self-sustaining system which entails human resources to provide eyecare services and spectacles to correct the vision impairment (5).

In Ghana, the National Health Insurance Scheme (NHIS) was established pursuant to the National Health Insurance Act of August 2003, and it is one of very few attempts by a sub-Saharan African country to attain a universal health insurance program that covers the entire population. The NHIS which is the major means by which the poor in Ghana access health care covers eye care services such as visual fields measurements, refraction, Keratometry and treatments like cataract surgery. However, the provision of corrective spectacles to address refractive errors which is the leading cause of vision impairment is excluded and not covered under the NHIS whereas lesser causes of vision impairments such as treatment of conjunctivitis are covered. This creates a major barrier to the access of corrective spectacles in the population especially children from deprived homes.

Thus, the major aim of this study is to explore a sustainable scheme that will address the unmet need of children with uncorrected refractive errors to corrective spectacles in Ghana. The study will be the first to be conducted in sub-Saharan Africa and the findings will be very useful to other low-middle income countries in sub-Saharan Africa and across the globe. The study will employ a mixture of qualitative and quantitative methods to address the research objective. Ghana Government health policy makers will be interviewed and a willingness to pay for spectacles survey will be conducted for parents. For the quantitative data, the Statistical Package for the Social Sciences (SPSS) v 29 will be used for analysis. NVivo will be used for a thematic analysis of the qualitative data.

The findings of the study are expected to positively influence the current health policy in Ghana with regards to children's access to corrective spectacles. This will be done by actively engaging the policy makers from the Ministry of Health and explaining to them the findings of the study. Also, findings of the study will be published to serve as a guidance for other researchers especially those from low-middle income countries.

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Electroactive Materials for Nervous Systems Regeneration by 3D/4D Printing

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Keywords: *Electroactive Materials, Nervous Systems Regeneration, 3D Printing, 4D Printing, Smart Materials*

Millions of people globally are in distress because of neurodegenerative diseases. Despite of the comprehensive knowledge on nerve injuries, regeneration mechanisms, and pathophysiology's, reliable therapies are scant that can guarantee complete functional recovery. Scientists have been trying to artifact bio-based therapies for the regeneration of neural tissues dysfunctionality. These approaches benefiting the nervous system interface with biomaterials empowers flexibility in materials selection and implantation (no/less surgery based) with augmented biochemical, biological, and physical functionalities. Given the associated challenges and complexity with regeneration of neural systems, stimuli-responsive (smart) materials and three-dimensional (3D) printing intersection has resulted in 4D printing advancement. Electrically conductive biomaterials as a group of smart materials have been on focal point of researchers due to their potential applicability in functional, biosensoric, and smart tissue-engineered implants and scaffolds. The potential of these materials in tissue engineering and sensory applications have been extensively investigated; however, these 3D/4D printed functional biomaterials and their applications are still under early explorations. Herein, the current advancements in the 3D/4D printing of electro conductive biomaterials employing various printing techniques are reviewed. Constituent mechanisms and materials for printing and preparations are discussed, and functional constructs are highlighted. Additionally, associated challenges are illustrated and several promising opportunities for progression in the field particularly in nerve regeneration as well as clinical translation prospective are given.

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Monte-Carlo Simulation of Infant Visual Acuity Testing

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Keywords: *Amblyopia, Screening, Monte Carlo Simulation, Visual Acuity, Clinical Significance*

Amblyopia, also known as “lazy eye”, is a visual development disorder of early childhood that significantly reduces vision from one of the eyes [1]. This condition can go unnoticed and, if left untreated will cause irreversibly poor vision. To be effective, treatment must be started in early infancy, and, population-wide screening of the visual acuity (VA) of young children is crucial [2]. Yet, screening tests for young children are very difficult to perform, and operator errors can impact overall clinical significance [3]. Attempts are ongoing to replace the highly skilled operators necessary for the testing with automated methods, which are also prone to errors in the individual testing steps. This work will explore the error rates required from the operators, or automated methods, for the tests to retain clinical significance.

Monte Carlo simulations [4] of the nine major preferential-looking VA test protocols used for screening amblyopia are under development. Within each simulation, a large number of sequential measurements of both eyes is taken, and patient and examiner errors are modelled to mimic actual screening, such as the patient’s attention span, examiner’s experience, and error rates. From there the clinical significance is determined by a statistical analysis of each protocol and of their comparison.

The result will allow assessment of each protocol and will determine how clinically significant their results are compared to alternatives. It will also give indications to the factors within the protocols that can be leveraged for their optimisation. Thus, improving the current screening process for amblyopia and, ultimately, contributing to the prevention of the irreversibly poor vision it causes.

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Eye Drops Design for Older People with Sensory Impairment

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Keywords: *Eye Drops, Self-instillation, Aiding device, Older people, Sensory impairment*

Many eye conditions such as glaucoma and age-related macular degeneration can cause serious visual impairment and affect the quality of life for affected individuals. Effective treatment with eye drops can help to slow disease progression, alleviate symptoms, and preserve vision [1]. However, for older people with sensory impairment, such as vision and hearing loss, using eye drops can be a challenging task due to difficulties in locating the eye and administering the drops accurately, in addition to other factors, such as fear of eye drops and movement difficulties [2].

Eye drops aid devices are available commercially. However, these devices still have significant limitations, and the adoption of these device is poor [3]. In my doctoral programme, the design of new eye drops aiding device will be pursued to assist people who cannot perform eye drops self-administration.

The study will comprise a PRISMA-compliant scoping literature review [4] to understand what has been explored about the eye drops instillation and limitations of current aids, device design, and experimental work to validate the device performance.

As a support activity, a phantom will also be developed, to assist with the design and in-vitro testing of the eye drop aiding device. The phantom consists of 3D-printed section mimicking the left eye and periorbital region.

Overall, the design for eye drops has the potential to improve the quality of life for older people with sensory impairments by enabling them to manage their eye conditions more independently and effectively. This study contributes to the growing field of inclusive design and highlights the importance of considering the needs of diverse user populations in product development.

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Your Well Being is for Sale: The Commercialisation of Biometric and Health Data

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Keywords: *biometric data, health data, commercialisation, human rights, data protection*

As technology has advanced and become more widespread, there has been an increasing drive to utilise it in innovative ways. One key area of this focus is healthcare. This trend has intensified with the emergence of Big Data and artificial intelligence (AI). Consequently, health data is increasingly used for commercial purposes within the healthcare sector. My research examines the legal regulations which enable this commercialisation and potential solutions for a fairer system.

A key aspect of my research is in exploring what is meant by health data and how companies exploit it for commercial purposes. Innovation in the healthcare sector is focused on the use of AI to either augment existing systems or create novel solutions. My research examines contemporary issues ranging from AI model ownership to commercial versus societal interest. Crucially we must examine the for-profit use of health data now before it is too late. The current justification of the 'common good' places us on a path which exchanges short-term benefits for long-term harm. My research explores the ethical dilemma that arises when companies with commercial interest act in the 'common good' and how human rights, combined with data protection, act as safeguards for a minimum level of protection.

My research findings are proposing policy recommendations for regulatory reform. The focus of my research is on European data protection, focusing specifically on the General Data Protection Regulation (GDPR) and the Draft AI Act. The GDPR's approach to data protection regulation can be characterised as a set of guiding principles with limited additional protection for special categories of data. Article 9 of the GDPR designates health data as a special category of data. This places additional obligations on data processors who aim to process health data. In practice, the GDPR does little to prevent the commercialisation of health data, instead opting to rely on the same principles for processing that govern non-special categories of data. Both regulators and processors rely on consent for lawful processing, rendering the extra obligations irrelevant. The focus on consent as the grounds for lawful processing places an unrealistic burden on the individual to understand what the implications of them using a particular service or product is. This approach allows regulators to hide behind the idea that they are representing autonomy and entrenches an information imbalance between companies and users. Instead of tacking on extra provisions onto

an existing regulation, there should be novel solutions to the issue of special categories of data, which go beyond the general mechanisms used for other data processing. It is crucial that regulators empower individuals, enabling them to better understand the implications of their actions when they agree to give away their health data.

It is important to stress one crucial point: this is not an argument for a moratorium on the use of health data, be that by companies or public bodies. Rather, my research urges caution. Innovation is the path of progress. It is how society moves forwards in leaps and bounds. However, when we seek to scale a novel solution, it is crucial to examine what the implications and impacts of this would be. Public healthcare bodies are intrinsically focused on providing better healthcare solution for society; companies and other commercial actors seek to make profit. While profit may be achieved in a way that also contributes to the common good, their purpose is not to prioritise individuals but rather their business interests. While new technologies provide new opportunities for innovative solutions, it is crucial that our legal regulations keep pace and for the basis of a fair system that balances commercial interests with fundamental rights and freedoms. Regulatory reform is necessary to better protect individuals from the rampant commercialisation of health data. It is critical to act before it is too late. Before our fundamental rights are discarded in the name of profit and 'progress.

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Effect of Fluid Shear on the Polymorphism of Seeded Crystallizations

Lucas Nahas Martinez

Crystallization is a widely used purification process in the pharmaceutical industry that involves the formation of crystals from a solution [1]. It is a crucial step in the production of high-quality drug products as it can significantly impact crystal properties such as purity, shape, size, and polymorphic form [1]. Polymorphism is a phenomenon where a compound can arrange its molecules in more than one crystalline form [2]. Different crystal forms can exhibit varying physical and chemical properties such as melting point, solubility or density [2]. Therefore, controlling the parameters that affect crystallization is of utmost importance to ensure the consistency and quality of the final product.

One of the primary challenges in crystallization is controlling the formation of crystals directly from the solution, known as primary nucleation. The nucleation process is inherently unpredictable, making it difficult to control [3]. For this reason, seeding strategies have been widely employed, where seed crystals of the desired form are added to the solution to promote their growth and induce the formation of new particles. These strategies have been proven to be useful in increasing the productivity of the crystallization process and obtaining a more consistent size distribution of the product [3].

However, seeding can sometimes fail to target a specific polymorph, which has led to notorious problems in the past. An example of this is Ritonavir, a drug used to treat HIV and AIDS, where inconsistencies in the crystal form of the drug impacted its therapeutic effect [4]. Therefore, a better understanding of the influence that seeding strategies can have on the polymorphic outcome is required. For this purpose, the two prevailing hypotheses that describe the origin of new particles in the presence of seeds need to be explained first. These are known as micro-attrition and surface breeding effects [1].

The micro-attrition theory suggests that collision among crystals generates small fragments of new nuclei derived from the parent seed [1]. Surface breeding theory postulates that solute clusters form on the surface of the seed and are subsequently displaced by fluid shear [1]. Both of these mechanisms are commonly categorized as secondary nucleation processes, as they result in the formation of new crystals in the presence of seeds. Nevertheless, they can result in different polymorphic forms as previously proposed in Myerson’s paper for the case of glycine [5].

In that study, a single-polymorph seed of the stable form of glycine, gamma, was impacted onto a surface and resulted in the creation of new crystals with various polymorphs. Although promising, distinguishing between the effects of attrition and fluid shear was not feasible in that case as the impact of the seed resulted in its surface abrasion [5]. Therefore, to address this limitation, we have used a "seed-on-a-stick" method instead, which entailed attaching a crystal seed of gamma glycine to a stick, immersing it in the solution, and subjecting it to fluid shear using an overhead stirrer. This approach enabled us to isolate the influence of fluid hydrodynamics surrounding the seed from the effects of attrition.

Overall, by understanding the effect of fluid shear on its own, we aim to better understand how distinct polymorphs can be generated through secondary nucleation initiated by single crystal seeds of known composition. This knowledge can then be applied by both researchers and manufacturers to optimize their processes to achieve the desired polymorphic form and minimize the formation of unwanted impurities.

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Parameters Affecting the Re-Design of New EBUS-TBNA Needle's Tip

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Keywords: *EBUS-TBNA, Soft tissue, Hyperelastic, Strain energy.*

Endobronchial ultrasound-guided transbronchial needle aspiration (EBUS-TBNA) is a biopsy procedure used for sampling lymph node tissue to stage cancer and diagnose granulomatous. The failure of this diagnostic procedure through inadequate tissue sample captures by the needle can affect the treatment of patients. The mechanical properties of soft tissues play an important role in the development of new EBUS-TBNA needle tips as the quality of the tissue sample determines the diagnostic yield, which itself is a measure of how likely it is that the procedure will provide necessary information to diagnose the disease correctly.

In this study, tissue sampling is being explored through mechanical testing. The present mechanical testing process consists of unconfined compression testing carried out on phantoms and various soft tissues on a displacement-control basis using the Mach-1 V500C (Biomomentum, Quebec, Canada). The results of this study confirm the nature of soft tissue as being hyper-elastic and a greater inter-sample variation when testing chicken breast.

Over the past two decades, EBUS-TBNA has transformed how clinicians diagnose lung disease [1]. The quality of the tissue sample is a vital factor that determines the diagnostic yield which itself is a measure of how likely it is that the procedure will provide the necessary information to diagnose the disease correctly. The design of the needle tip, the angle at which it is aligned and the motion of its tip inside the lymph node can all affect the quality of the biopsy samples. Several studies have been carried out on the development of designs that can improve the diagnostic yield, which currently stands at around 60%. These studies were conducted using computer simulation and experimental testing on animal studies [2].

A new needle's design must encompass the knowledge of the lymph node's mechanical properties, the force acting at its tip and shaft. In addition, the parameters affecting the design have to be considered. Finally, a computer simulation capable of fully replicating the actual operation is necessary. The aim of the work currently underway is to improve the design of the EBUS-TBNA needle tip to increase the diagnostic yield of the procedure.

Any type of biological material that can experience large deformation under small load and retain its initial configuration is referred to as soft tissue material. Soft tissue material is characterised by its incompressible and non-linear properties which are expressed by its strain energy function ''SEF' [3]'. Since human tissue can be hard to obtain and test, the work that is presented involves understanding the non-linear properties of soft tissue through mechanical testing. The mechanical testing involved

an unconfined compression test performed on a displacement control basis using a mechanical tester (Mach-1 V500C, Biomomentum, QC, Canada) on chicken breast, as a generic, readily available soft tissue; large pickled capers, as a geometric mimic of a lymph node; PVA hydrogel, as a reproducible phantom material which can be tailored to have different properties. Even though the properties of chicken breast and large pickled capers differ from those of lymph node, they can still be used to create mechanical responses of value for needle testing.

The soft tissue material exhibits a non-linear elastic behaviour, Fig.1, which is considered to be hyperelastic. Testing on chicken breast showed greater inter-sample variation and this is still under exploration.

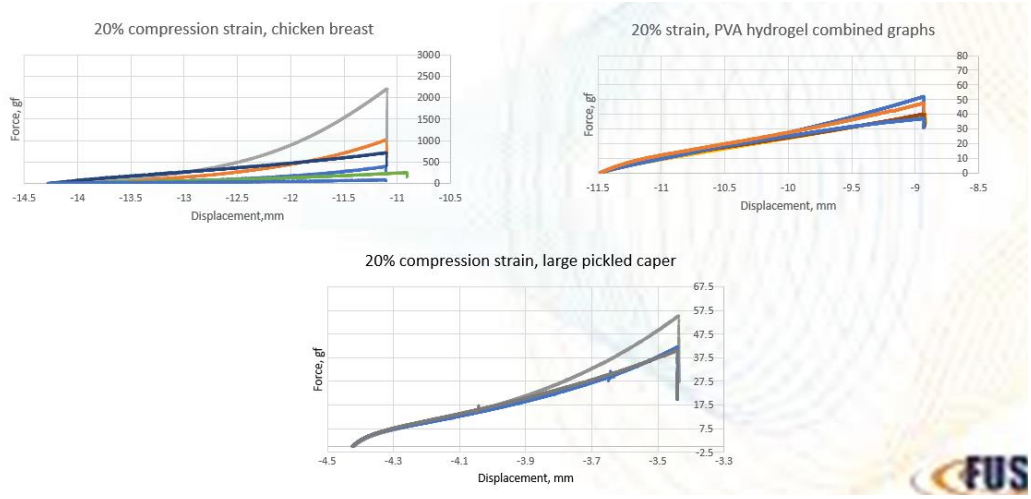

Figure 5: Unconfined compression tests on various soft tissue

This work highlights the use of mechanical testing methods to characterise soft tissue and the tools used with it. The results of the study to date conform to the literature and have the potential to serve as a starting point for the development of methodology for the redesign of EBUS-TBNA needle tips.

Future work will include a computer model study, to analyse the stress-strain graphs obtained from mechanical testing and determine the best hyperelastic model constant parameters characterising soft tissue. The transition between soft tissue layers during needle insertion can lead to a series of event that can cause tissue deformation and rupture, hence through needle insertion experiments, forces acting along the needle and the tip when it comes into contact with tissue will be studied. The results obtained from the needle insertion experiments and the tissue characterisation will then be explored further with modelling.

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Exploring Protease Signalling within the Cell Utilising Super Resolution Microscopy

Marco Bonfanti [a], *Lisa Van Den Driest* [a], *Tianshu Qu* [a], *Angéline Geiser* [a], *Peter Tinning* [a], *Margaret Cunningham* [a]

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Keywords: *PAR4, Mitochondria, Proteomics, GPCR, Super resolution microscopy*

Protease activated receptor 4 (PAR4) is a G protein activated receptor (GPCR) that is activated when a part of it is cleaved by another protein (1). GPCRs, like any cellular receptor, are activated when a molecule binds with it like a key with a lock. PARs are a unique family of receptors which are activated by enzymes, which cut the receptor causing a conformational shape change, thus leading to intracellular signalling. GPCRs are a family of hundreds of receptors, but to this day only five GPCRs have been found in mitochondria (2), the powerhouse of the cell. PAR4 has been characterised only on the surface of cells, however previous work from our laboratory suggested that a cluster of interacting proteins regulated cellular energy production in mitochondria. This raised the question to whether the receptor could localise in this organelle. We also thought that deleting a specific part of PAR4 might affect its location in mitochondria and within the cell.

To test these hypotheses, we imaged the receptor using microscopes. Unfortunately, mitochondria are tiny structures (0.5 to 3 µm) (3), and are quite difficult to image using conventional microscopy methods, as there is a physical limit to the maximal resolution that an objective can achieve. To overcome this issue, we are planning to use different methods called super resolution microscopy, which circumvent this physical limitation. The two main methods that we are planning to use are called Stimulated Emission Depletion (STED) microscopy (4) and structured illumination microscopy (SIM) (5). We hope that these methods will allow us to look at PAR4 and its interacting proteins directly on the mitochondrial surface.

While the study is ongoing and more testing is needed to confirm the results, we have found preliminary evidence that PAR4 can indeed be found in mitochondria and that deleting the specific part of PAR4 affects its location. This finding could lead to future studies investigating the function of PAR4 in mitochondria, such as how it affects energy production. Since these experiments were performed in pluripotent stem cells, this research acts as a case study, and it is not relevant to any clinical condition in particular. We suggest exploring the presence of PAR4 in other types of cells, like cardiac cells, which have high energy demands and therefore a greater presence of mitochondria.

In summary, PAR4 is GPCR that can be found both on the surface of cells and inside mitochondria. Deleting a specific part of PAR4 affects its location in the cell. The ongoing study aims to confirm these findings and explore the potential function of PAR4 in mitochondria, which could have implications for energy production in cells.

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Optimal Parameter Choice for Imputing Missing Values in Water Level Data Using the *K*-Nearest Neighbour (*K*nn) Method

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Keywords: *kNN, missing values, water level, parameter choice, single imputation*

Missing values in data is a problem which data analysts in most areas of research must deal with, before analysis. Ignoring missing data values will cause loss of information and efficiency, and unreliable results, especially where large proportions of the dataset are missing [1]. Various approaches are used to manage missing data, notably single and multiple imputation [2]. Imputation methods replace missing data values. Single imputation replaces each missing value with a single value [3], while multiple imputation generates two or more values for each missing value [4]. The *k*-nearest neighbour (*k*NN) method for imputation is a single imputation method. It uses the *k* most similar observations (nearest neighbours) in the dataset to identify a replacement for a given missing value, but a suitable value of *k* must be chosen beforehand. When $k=1$, the replacement value is obtained as the observed value for the variable of interest from the nearest case to the case with a missing value. When $k>1$, the average of *k* observed values is used as the replacement value, where these observed values are the responses from the *k* nearest cases. First of all, *k*NN identifies the *k* nearest observations to each case with a missing value, by calculating the distances between the observed variables for that case and all other cases in the dataset [5,6].

It is important to identify the most suitable value for *k,* to achieve the most accurate data replacements. Muinonen et al. [7] state that imputation accuracy from *k*NN does not improve for $k>3$, however McRoberts et al. [8] found that a higher value of *k* ($k\geq7$) may improve estimation accuracy and have lower variability of results. Because of these contrasting views, this work examines the performance of $k=1,3,5,7,9,11$ and 15, to identify the optimum value of *k*. It uses monthly water level datasets from the Nigeria Hydrological Services Agency (for years 2011-2016) from three water stations, Ibi, Makurdi and Umaisha water stations on the river Benue in Nigeria. As these data themselves contained missing values, time series models were fitted to each dataset and complete data were simulated from those models for this study. Missing data at rates 10%, 20%, 30%, 40%, and 50% were then created using three missing data mechanisms, missing at random (MAR), missing completely at random (MCAR), and missing not at random (MNAR), on the simulated data and imputation was carried out on these.

Two measures were used to assess performance of *k*NN with each percentage missing and each value of *k*, for each water station: root mean square error (RMSE) and mean absolute percentage error (MAPE). The results for the MAR and MNAR missing data mechanisms are similar, suggesting $k=7$ and $k=15$ as generally best, but sometimes $k=3$ also does well, especially for the MCAR mechanism. Overall, $k=7$ and $k=15$ consistently produce the best performance (lowest mean and standard deviation values of either RMSE or MAPE) for the five percentages missing and all three missingness patterns considered. In general $k=7$ is a good choice, but $k=15$ is better for these datasets. This result agrees with the findings in [8].

These results will allow more accurate replacement of missing values in water level data and hence more reliable conclusions from statistical analysis of these datasets.

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Cultural Identity Preservation in a Modernizing Society: A Theoretical Framework for Safeguarding the Cultural and Architectural Identity of Heritage Buildings in the South-south Region of Nigeria

Samuel Etopidiok

Keywords: Heritage Buildings, Cultural Identity, Cultural Heritage, Preservation

In a world with over 8 billion humans, every individual has a unique marker which serves as an identity. This unique maker is known as Deoxyribonucleic Acid (DNA). Through DNA matching, an individuals' genetic makeup can be linked with that of another individual thousands of miles away. Through this genetic code, an individual's identity can be traced down to their ancestry. In the world of today, buildings serve as DNA capsules or vessels which contain vital information about past civilizations, lived experiences, cultures etc.

An individual's culture also serves as a distinctive marker that links an individual to another. Heritage buildings are structures of cultural significance. These buildings serve as an identifying mark that captures the lived experiences of the past (cultural heritage). It serves as a blueprint of society, capturing the principles, character, achievements, and ultimate demise of societies throughout history. The destruction of these buildings means the destruction of cultural identity. Culture loss is imminent when these buildings are destroyed. The survival of this identity is presently threatened in a society marked by an increase in science and technology, migration, climate change, ethnically varied communities, and global trends. This usually results in the disappearance of cultures and civilizations vanishing under the icy claws of time. An incalculable loss to humankind results from the loss of a people's cultural identity. Nigeria is a nation with rich cultural heritage that goes back to 500 B.C. This rich heritage is evident in the various distinct ethnic communities that are present in the country. The rich value system for culture which protected heritage buildings in this region is gradually getting been lost to time, and this has resulted in poor preservation strategies, ineffective government policies for the protection and preservation of these structures. The Nigerian government, over the years actively taken steps to preserve the cultural legacy of the Nigerian people but this has not produced the desired outcome.

This study centres on the use of historic structures as an approach to preserving a people's cultural identity. The effective preservation and protection of these heritage structures depends heavily on tacit understanding of the customary management systems of these heritage properties. My strategy to preserve heritage buildings will be centred around the people. This will be archived through the integration of both passive and active approaches to preservation. The purpose of this thesis is to create a framework for the preserving of cultural legacy by safeguarding the distinctive architecture of South-South Nigeria.

The findings of this study will be published in articles, books, and presentations at seminars and conferences, with the aim to contribute to the related theories and relevant policies and practices in Nigeria.

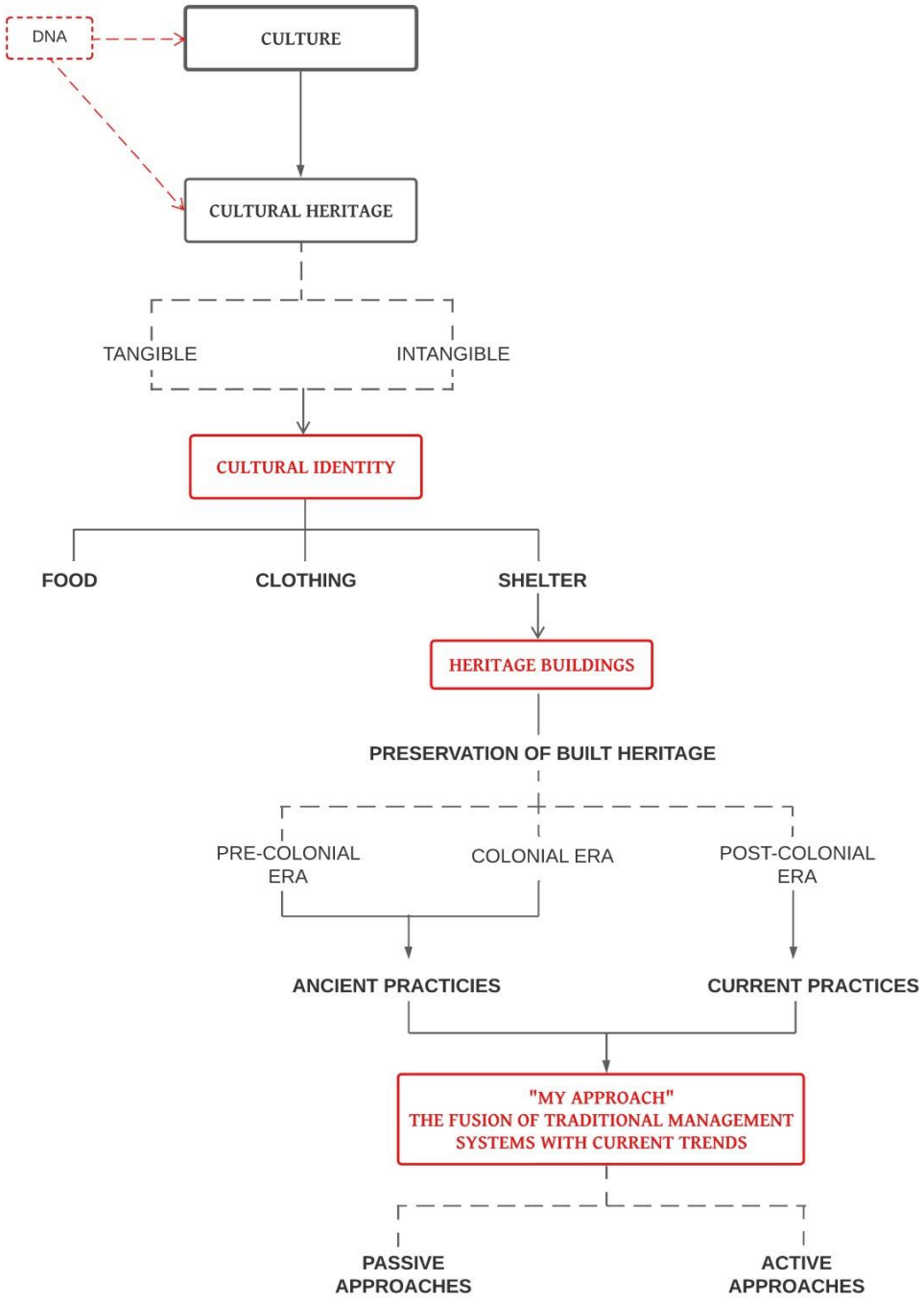

Fig 1: Description of research

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Exploring the Characterisation and Sub-classification of Ataxic Dysarthria

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Keywords: *ataxia, dysarthria, speech, acoustic analysis*

Ataxia, a group of neurological disorders, impacts muscle coordination, gait, balance, and speech, leading to a specific type of speech impairment known as ataxic dysarthria. Previous research on ataxic dysarthria has predominantly focused on common progressive ataxias. Consequently, there is a lack of information on speech manifestations in a wider ataxia population, resulting in challenges in the timing and method of their management.

The purpose of this research is to investigate speech impairment, its relationship with cognition and motor symptoms, in lesser-studied ataxia types, which have previously received little to no attention in the scientific community. The ultimate goal is to contribute to improved understanding and management of speech manifestations in a broader range of ataxia patients. The study aims to achieve these goals by analyzing the speech of participants from multiple rare ataxia types and assessing how their speech characteristics correlate with cognitive and motor symptoms.

Participants will be recruited through their neurologists, general practitioners, or via online advertisements. Speech will be assessed through a variety of tasks, analyzed both perceptually and acoustically. To facilitate data collection, all speech and cognitive assessments will be conducted remotely. Motor assessment scores and medical notes related to ataxia will be accessed through the participants' neurologists.

The data will be used to identify differentiating factors between the various ataxia types and to determine how symptoms vary across individuals with different disease severities and forms. This research will also explore how speech impairments relate to participants' broader motor symptoms and cognitive capacities. The project is expected to span three years, encompassing participant recruitment, data collection, and data analysis.

Although the study is still ongoing, the potential implications of the research are significant for both the field of ataxia research and for patients living with these rare neurological disorders. By characterizing speech impairments in lesser-studied ataxia types, the study aims to facilitate the development of tailored therapeutic interventions and improve the timing and method of management for these patients. This research will also contribute to a more comprehensive understanding of ataxia as a whole, ultimately benefiting the wider scientific community and society.

In conclusion, this research seeks to bridge the gap in knowledge regarding speech impairment, cognition, and motor symptoms in lesser-studied ataxia types. By investigating the relationship between these factors, the study aims to provide valuable insights into the management and treatment of speech impairments in a wider range

of ataxia patients, ultimately improving their quality of life and contributing to the broader understanding of ataxia-related disorders.

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Designer Empathy in Virtual Reality: Transforming the Designer Experience Closer to the User

Amy Grech

Keywords: *Empathy; Virtual Reality; Human-Centred Design; Design Engineering; Product Design*

Empathy is a key driver for designers to fully understand the perspective of users who end up using their product or service (Giacomin, 2014). However, too little, or too much empathy can prove to be detrimental to the creative design process and therefore a structured approach is vital (Genco et al., 2011; Johnson et al., 2014). The current emergence and capabilities of Virtual Reality (VR) technology has inspired this research to explore how designers can achieve the optimal level of empathy required to produce innovative design solutions for users.

A qualitative study involving semi-structured interviews with design engineers working with industry was performed to analyse current challenges in empathic design and identify how VR can address such challenges. The study highlighted that communication, and the available resources were the main factors influencing designers in experiencing empathy towards their user. In response to this finding, this research brings designer closer to the user through the digital transformation of the design engineering profession that provides enhanced value to human-centricity, social and ecological interactions.

The outcome of this study entails the creation of a specification for a novel fully immersive virtual environment: Designer Empathy in VR that augments designers' empathic skills and empowers the designer to achieve the optimal level empathy towards their user through multiple perspectives. Through the future configuration of VR tools and empathic methods to support designers, the goal of this research is to perform empirical studies on an operational VR environment. This environment will analyse the impact of this application on designer's empathic skills enhancement and on creating more inclusive user-oriented design solutions focused on a healthier humanity.

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Poster Presentations

Solutions For Sustainability

Development of a Novel Electrochemical Biosensor for the Detection of Fungi in situ

Adam Hughes-Buchanan, Grainne El Mountassir [a], Andrew Ward [b]

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Keywords: *Biosensors, Fungi, Soil, Electrochemistry, Landslides*

Landslides have negative annual economic impacts and can endanger human life. Current interventions for dealing with slope instability are often energy intensive and expensive. The manufacture of materials used in such interventions, such as cement, generate high levels of emissions. Current research at the University of Strathclyde is investigating the potential of using fungi as a nature-based approach to reduce water infiltration in slopes vulnerable to landslides after heavy rainfall. These landslides occur due to a loss in contact forces between soil particles as the soil becomes saturated with water, thus reducing the soil's ability to maintain its shape. The fungi will stabilise the slopes by filling the pores in the soil and by increasing the ability of the soil to repel water.

A challenge associated with nature-based approaches is monitoring the influence and fate of the intervention in the field due to the complex nature of the systems involved. The presence of the fungi in the soil must be monitored such that any effects on the slope characteristics can be attributed or not to the intervention that was deployed. Current approaches for the detection of microbial biomass in soil such as culture based methods, chromatography, and chemical based assays are laboratory-based, labour intensive, and time consuming.

The objective of this project is to develop a low cost, portable electrochemical biosensor able to detect fungi in the field. It is proposed that the biosensor will be based on the detection of fungal exudates or components of the fungal cell. Fungal exudates, such as hydrophobins, which have water repelling properties, while ergosterol, which is a sterol unique to fungi that controls the fluidity of the cell's membrane. Components in the fungal cell include phospholipid fatty acids (exclusive to viable cells) and chitin (a major constituent of the rigid cell wall). This project demonstrates a new avenue of research in the domain of electrochemical biosensors for environmental monitoring applications used in conjunction with large scale geotechnical engineering strategies.

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An Investigation into the Application of Flame-Retardant Phase Change Materials for Electric Vehicle Battery Thermal Management

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Keywords: *Battery Electric Vehicles, Lightweighting, Phase Change Materials, Battery Thermal Management, Fire Safety*

Battery electric vehicles (BEVs) have emerged as one of the most promising technologies for combating climate change, releasing no harmful emissions during operation. However, the significant charging time and limited driving range present major challenges, not helped by the fact that the battery pack (which contains the battery cells and subsystems necessary for vehicle operation) has a very high weight. For example, the Tesla Model S battery pack accounts for 28% of the overall vehicle weight (Charlton , 2021). Lightweighting (i.e., the process of reducing the weight of a product through design optimisation) has become critical in automotive design to enhance fuel economy during operation and reduce raw material consumption during production. In the context of BEVs, a 10% reduction in weight can amount to a driving range increase of 13% (Czerwinski , 2021); therefore, finding opportunities for lightweighting is critical for maximising the driving range and supporting the market growth of BEVs.

A subject of considerable interest for battery pack lightweighting is phase change materials (PCMs) for battery thermal management. Compared to typical liquid or air battery thermal management strategies, which rely on extensive hardware and equipment to operate, PCMs can provide thermal management independently due to their ability to store and release heat during their phase transition (i.e., from solid to liquid state); therefore, can contribute to vehicle weight and energy savings through the reduction of parts. Further benefits of PCMs for thermal management include reduced pack maintenance needs and more straightforward manufacture/assembly.

That said, when considering various lightweighting opportunities, it is essential not to compromise the safety of BEVs, especially since the battery cells can pose a fire hazard due to thermal runaway (which can result in the expulsion of jet-flaming, smoke, and toxic gases from the cells if not managed correctly). A primary issue concerning numerous PCMs being considered for thermal management is that they can aggravate thermal runaway due to their inherently flammable nature. For instance, (Wang , 2020) demonstrated that Paraffin - one of the most widely considered PCMs for battery applications - could encourage thermal runaway propagation to adjacent cells, thus creating a chain reaction that would be challenging to control and extinguish. For that reason, there remains scepticism regarding the use of PCMs for battery thermal management in BEVs.

With the need to widen the opportunities for lightweighting in the automotive sector, this research explores a branch of bio-based flame retarded PCMs with the overarching aim of delivering design rules to support their application. Data gathering techniques include experimental thermal analysis and standardised bench-scale fire tests. The data will be compared to existing research on PCMs to validate their

suitability in relation to their heat storage capacity and fire behaviour. Furthermore, numerical models will be used to gain insight into the flame retarded PCMs' behaviour during regular battery charge/discharge cycling and throughout a thermal runaway outbreak.

So far, research has revealed that the flame retarded PCMs unexpectedly achieve a greater heat storage capacity than typical Paraffin grades; therefore, they may offer more effective thermal regulation. Additionally, numerical modelling made apparent that the excellent heat storage capacity of the flame retarded PCMs may help to absorb excess heat during thermal runaway. Moreover, the excellent heat storage capacity and the PCMs' flame-retardant nature help delay thermal runaway propagation to adjacent cells in the pack. These initial findings indicate that the branch of flame retarded PCMs may contribute to the fire safety of BEVs by reducing the severity of thermal runaway. The research output intends to support the safe implementation of PCMs in BEVs as a strategy to improve driving range and energy efficiency.

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Risk Averse Model for Sustainable Bioproducts Overproduction

J. Alexander Vindel-Garduno, Ashwin Arulselvan [a], Mahdi Doostmohammadi [b].

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Keywords: *Risk Averse Optimization, Sustainable Production, Bi-Level Programming, Metabolic Engineering, Decision Making*

The research purpose is to present a novel methodology (algorithm) to solve a hierarchical problem with competing objectives in metabolic engineering to generate risk-averse strategies.

Sustainable solutions can be derived from making the most out of our limited resources, i.e., optimizing in the smallest places. There's natural production of chemicals in a bacteria's growth. The idea to modify a microbe's structure to increase the production of a desired chemical is not new. Methods to alter an organism's structure can be found in metabolic engineering. Where engineers use gene deletion and mathematical modelling to alter the chemical connections in the microbe to redirect mass flow to a particular reaction. The problem is suggesting a gene deletion that optimizes two competing entities' objectives. This is best modelled as a hierarchical structure involving two decision makers, a leader and a follower. On the one hand, the engineer's (leader) objective of maximal chemical overproduction. And on the other hand, the bacteria's (follower) own evolutional objective, namely growth.

I would be fair to assume that no matter the gene deletion strategy, the bacterial growth will be aligned with the chemical production. Commonly known as the optimistic case where the follower's solution given the leader's strategy will have a positive impact on the leader's solution. However, the follower's solution could be detrimental to the leader's solution, referred as pessimistic approach. By solving the pessimistic approach, the engineer ensures the "best of the worst" solution, thus reducing the risk of selecting a valid gene deletion strategy that yields a poor chemical production.

Hierarchical structures with competing objectives can be found in most research fields from transportation networks, electric grids, city planning, to surveillance and even policing. Therefore, presenting more methodologies to face these types of problems has a positive impact in our society as more complex problems could be modelled and solved leading to a more effective use of our resources.

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A Path to Sustainable Energy Solutions in Neighbourhoods: Predicting System State for the last mile of power distribution Networks

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Keywords: *LV network, Probabilistic model, Machine learning, Power system modelling, Transfer learning*

With the deployment of new embedded energy sources and electric vehicles, there are more opportunities to achieve decarbonization. However, this may also pose challenges to distribution networks, pushing them beyond their original design specifications. The resulting extremes of prosumer loads can lead to unexpected excursions in current and voltage constraints on distribution networks, potentially causing power outages and accidents.

"Low voltage" is a somewhat ambiguous term and it is worth defining. In Great Britain, voltages are stepped down from 400kV at the power station to 132kV at the substation at the high voltage level. They are further reduced to 11 kV and 33 kV levels at the medium voltage level in distribution systems, which typically serve around 50 households. Finally, voltages are brought down to 415V at the consumer level.

While there is a substantial body of literature on forecasting at the high voltage level, the uncertainty at the low voltage level introduces many new challenges, especially within the range of 132kV down to 11kV or from 11kV down to 415v. Given these complexities, more advanced and novel ideas and methods are needed to handle a broader range of data at the low voltage (LV) level. [1]

Weather changes or usage patterns can lead to a need for dynamic state estimation for the LV network – estimating changes in the network state over time. Utilizing a forecast for pseudo measurements in a network state estimator is a well-established practice. A pseudo measurement is an artificially created measurement used when real-time measurements are not available for the system. These are typically derived from historical data, load flow studies, etc. However, there are several challenges that require specialization for distribution networks. Firstly, the levels of observation on distribution networks are relatively low, meaning there are fewer data points to base a forecast on. Secondly, the load relations between buses on LV distribution networks are not linear or Gaussian, meaning that conventional least squares state estimation results in a sub-optimal model. This study provides a two-fold solution to these problems for dynamic state estimation on LV distribution networks: the transfer learning of models for bus pseudo measurement prediction, and a novel means of state estimation for distribution network load relations. The contribution is tested on an actual GB distribution network feeder. Transfer learning is a technique where a pre-trained model developed for one task is used as the starting point for a model on a second task. This can significantly reduce computational expenses and improve performance.

This research aims to provide insights into the design and deployment of sustainable energy solutions that can enhance the reliability and efficiency of the low voltage network power system. In alignment with the Horizons for Humanity theme, this study employs cross-cutting and novel interdisciplinary approaches to forecast low voltage network behaviour and prevent power outages. The research results will reduce the need for extensive monitoring infrastructure, thereby contributing to a low-cost solution for the measurement and prediction of the low voltage network state. This will contribute to a more sustainable energy future by ensuring that low carbon technologies can be adopted at scale across these large populations of assets.

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Integrated Systems Design of Composite Casings for Power Electronic Converters

Mark Higgins, Dr Catherine E. Jones [a], Dr Rafael Peña Alzola [b], Prof. Graeme Burt [c]

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Keywords: *Net-zero aviation, Lightweighting technologies, Power electronic Converters, Power electronic systems, Carbon fibre reinforced polymer*

The electrification of power and propulsion systems on aircraft is a key technology enabler to meet ambitious targets set for decarbonization of air travel, directly supporting the UN's Sustainable Development Goals of Building Resilient Infrastructure (9) and Taking Urgent Action to Combat Climate Change (13). To achieve this, new electrical power systems and associated equipment are needed, rated at much higher power levels than state-of-the-art more-electric aircraft (multi-megawatt, compared to 1 megawatt). A significant barrier to the development of these systems, is the weight of the electrical power system. In particular, power densities of electrical machines and power electronic converters are required to be at least 3-5 times higher than that of a traditional aircraft power system by 2025 [1, 2]. This project is focussed on the lightweighting of power electronic converters, by developing design methodologies for power electronic converter units with carbon fibre reinforced polymer (CFRP) casings.

Carbon fibre reinforced polymer (CFRP) is established for use in aero-structures: More than 50% of the structure of a state-of-the-art more-electric aircraft (MEA) is made from CFRP, reducing the total structural weight of an aircraft by ~20% [3]. However, systems are designed such that electrical power systems and the CFRP structures do not interact. The electrical conductivity of CFRP is ~1000 times lower than that of aluminium [4], and the electrical properties of CFRP are complex, and poorly understood to date. Without this knowledge, designing a system where an electrical fault will not lead to catastrophic failure, or has appropriate levels of electromagnetic shielding, is not possible. Hence, to design light weight electrical power system equipment, such as power electronic converters, the electrical interactions between the CFRP casing and the electrical power system must be understood and the electrical response of the CFRP captured to subsequently enable design rules and methodologies to be established.

To capture these design rules, three sub-topics must be addressed. The interactions between the power electronic converter and the casing fall into two broad categories: low frequency (<MHz) current conduction during electrical fault conditions, and high frequency (GHz) interactions due to electromagnetic interference (externally from lightning strike, internally generated by the converter). Therefore the first sub-topic to be explored is the impact of the CFRP casing on the electrical fault response of a system. This requires the low frequency (<MHz) electrical response and conducting electrical pathways through CFRP to be evaluated. The second-sub topic is to capture the EM shielding capability of a CFRP casing. This requires the high

frequency (150 kHz to 6 GHz) characteristics to be experimentally captured and evaluated. Finally, the third sub-topic is to integrate the electrical knowledge of the CFRP with the design of the power converter and its associated filters.

The poster will present experimental results from the electrical characterisation of a typical CFRP layup to date, and provide a quantitative assessment and design trades of approaches to electromagnetic shielding (shielding effectiveness, methods of achieving shielding effectiveness), with the interdependent design criteria for power converter common mode filter design, including approaches to electrical grounding and bonding. The poster will combine this knowledge with a sub-system of a future aircraft electrical power system (which includes a power electronic converter), to capture system design trades, limitations and design rules. Longer term these will provide a platform for the next generation of aircraft industry standards. This will enable significant improvements in power densities of aero-electrical power system equipment for increased electrification of power and propulsion systems and the associated decarbonisation of aviation.

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An Overview of Path Planning for Autonomous Robots in Smart Manufacturing

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Keywords: *Robotic and* Autonomous systems (RAS); smart manufacturing; path planning algorithms; artificial intelligence; challenging environments

Robotics and Autonomous systems (RAS) are increasingly playing an important role in the manufacturing sector as a key technological driver of Industry 4.0, integrating robots into advanced engineering systems with self-tuning and adaptive capabilities.

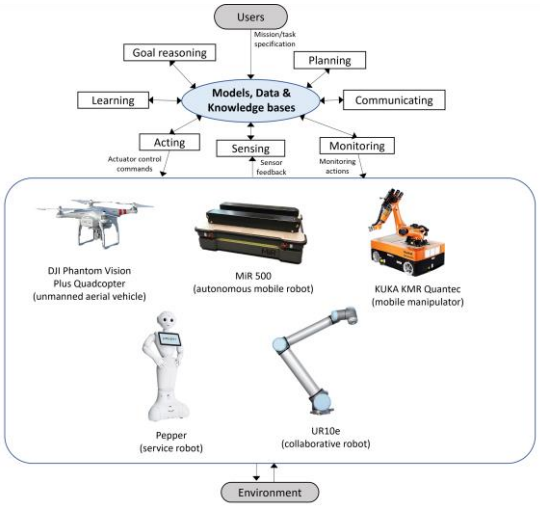

Figure 6. Overview of RAS, including various key functionalities and examples of robots used in manufacturing industry (adapted from [4])

In traditional manufacturing, industrial robot manipulators were used for well-controlled and predictable environments that are tailored for a specific task to be performed repeatedly and at high speed. In contrast, in the new smart manufacturing setting, modern robot designs – such as unmanned aerial vehicles (UAVs), autonomous mobile robots (AMRs) and collaborative robots– are provided with enhanced motion capabilities and various functionalities (Figure 5), enabling them to deal with a broad range of environments (e.g. unknown, unstructured, dynamic, cluttered/crowded, hazardous, inaccessible, resource-constrained) [1] and tasks (e.g. advanced composite manufacturing [2] and automated warehouses [3]) with varying degrees of autonomy. RAS can offer many advantages such as improved productivity and safety by preventing accidents, errors, and reduced labour costs.

One of the key ingredients for the successful deployment of RAS is motion planning (also known as robotic path planning) which, combined with artificial intelligence (AI) studies, can increase the flexibility and level of intelligence of robots: this provides them with the cognitive ability to decide how to move safely using algorithms that translate high-level task specifications into low-level executable motion control. Implementing the most appropriate path planning approach for autonomous robots in smart manufacturing can be challenging due to the extensive variety of methodologies presented in literature.

Therefore, this research aims to provide a comprehensive review of path planning solutions towards smart manufacturing. First, a general planning framework is presented to clarify some of the main terminology and elements of robotic path planning (Figure 6). This is followed by a critical review on common planning

approaches to identify the capabilities and limitations of autonomous robots in different smart manufacturing applications (TABLE I). From this survey, it has been evident that AI-based path planning methods are increasingly implemented to design more adaptive and intelligent robots capable of handling highly dynamic and complex environments. There is no doubt that a hybrid planning approach based on a combination of machine learning techniques with traditional path planning algorithms can guarantee safety, operational efficiency and flexibility, which requires further detailed investigation in future.

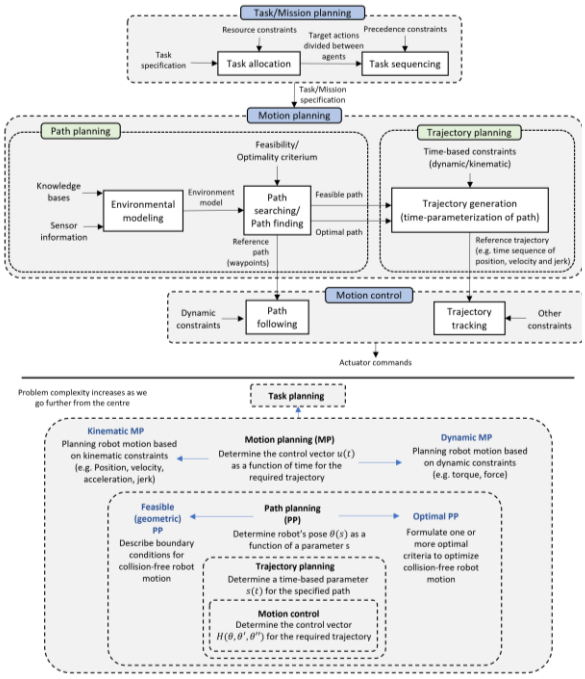

Figure 7. General framework, outlining the relationships between relative planning concepts

TABLE I: Classification of robots in smart manufacturing based on level of autonomy

Robot type	TTask variability	Environment characteristics	Industrial applications	Planning approaches
Automatic	Low	Structured, predictable, environment (e.g. workcells)	Palletizing, additive manufacturing, digital fabrication	Deliberative
Autonomous	Medium	Partially unknown, unstructured, dynamic, crowded/cluttered,	Material handling and transportation, structural inspection, cleaning	• Hybrid
Situation-aware	High	Fully unknown, unstructured, inaccessible, hazardous, extreme, expansive, resource-constrained environment	Indoor surveillance, structural inspection, material handling	• Reactive • Hybrid

Ultimately, the end goal of this research is to implement a novel adaptive path planning algorithm into the design of an end-to-end RAS that can autonomously inspect and handle manufactured parts, not only save time and reduce labour costs, but also contribute towards sustainability. In fact, this will allow for high-value industrial sectors (e.g. composite material, nuclear, aerospace) to:

- strongly contribute to greater economic prosperity and engineering status with high-quality and reliable inspection of parts
- support the transition to low carbon economy with re-manufacturing (e.g. inspection of used parts for re-commissioning) which strong emphasis on preventive waste and resource efficiency.

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Failure Modes of Carbon Fibre Reinforced Polymer: A Review

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***Keywords**: Carbon fibre reinforced polymer, taxonomy of failure modes, aircraft structure, electrical power system*

Carbon fibre reinforced polymer (CFRP) is widely used for aircraft structures, owing to its lower density and superior mechanical properties compared to aluminium. More than 50% of structures on state-of-the-art aircraft are made from CFRP.

Aircraft operation is safety critical. However, aircraft operate in a hazardous environment: extreme temperature, low air pressure, vibration and high risk of lightning strike. Therefore, aircraft structures and systems are highly prone to a variety of failure modes. Characterisation of damage caused to CFRP is more difficult to articulate due to the inhomogeneity and non-linearity associated with CFRP properties compared to aluminium.

If failure modes are not well understood, then systems with CFRP aerostructures require significant over-engineering to ensure that catastrophic failure cannot occur. Such over-engineering brings weight and volume penalties and prevents optimised systems design. For example, in state-of-the-art aircraft electrical cables must be kept physically separate and distanced from CFRP structures.

This research investigates the factors which incur damage and degradation to CFRP aerostructures. In pursuit of this, a taxonomy which collates causes of failure and resulting degradation to CFRP is produced. In this taxonomy, failure mechanisms are categorized based on high and low temperature, environmental moisture content, corrosion resistance, Mechanical (stress, strain, impact) and electrical failure modes are including EMI (Electromagnetic Interference), lightning strike, galvanic corrosion. The degradation is categorized in terms of reduction of CFRP strength such as fatigue resistance, microcracking, delamination, fibre fracture, resin rich areas, surface blistering. Furthermore, NDT (Non-Destructive Testing) and DT (Destructive Testing) methods for detecting degradation are also included.

This research will provide a comprehensive overview of a taxonomy of failure modes, degradation and damage, and methods of detection, for CFRP structures in aircraft applications. This will enable future design of health monitoring, detection, prediction and intervention strategies for design of CFRP-based systems for lightweighting of future aircraft. This includes interaction between electrical power and structural components.

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Exploring the Influence of Digital Fatigue in Instruction Post-Covid-19 Era on Higher Education Students' Performance: An Overload Perspective

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Keywords: *technology overload, information overload, communication overload, digital technologies, digital fatigue.*

Since the onset of the COVID-19 pandemic, educational institutions have shifted from traditional teaching and learning methods to remote learning in order to minimize the spread of the virus and adhere to social distancing guidelines (Ferdig et al., 2020). This transition has involved the utilization of digital technologies for online teaching and learning. In the post-COVID-19 era, digital technologies continue to play a crucial role in providing learners with opportunities to engage in various educational courses, including blended or fully online formats. However, it is important to recognize that the use of these technologies may have an impact on students' performance. One significant concern is the potential for technology-induced fatigue, which can lead to a deficit in learning outcomes (Halupa and Bolliger, 2022; Fauville et al., 2021).

This study will investigate the impact of three dimensions of technology overload, namely information overload, communication overload, and system feature overload, on digital technologies learning among students in the post-COVID-19 era. While technology-enhanced learning offers several advantages for distance education, it also brings potential challenges such as techno-stress and technology fatigue, which can have negative effects on students' well-being and academic performance. Prior research has demonstrated that excessive overload can lead to physical and mental exhaustion, decreased creativity, and reduced productivity (Lee et al., 2016; Ayyagari et al., 2011; Tarafdar et al., 2015; Karr-Wisniewski & Lu, 2010). The study emphasizes the significance of addressing these factors to enhance student engagement and satisfaction in the context of online education.

The primary aim of this study is to investigate the role of different types of technology overload as a mediator between ICT characteristics and technology fatigue, and their impact on the academic performance of students at the University of Strathclyde Glasgow in the post-COVID-19 pandemic era. It is crucial for academics, ICT developers, and policymakers in higher education institutions to pay adequate attention to the issue of overload, considering its potential implications.

The integration of the Person-Environment Fit model and the Transactional Theory of Stress and Coping can provide a comprehensive framework to examine the influence of technology overload on videoconferencing fatigue and academic performance among higher education students. The P-E fit model can be used to assess the match between the demands of video conferencing characteristics and students' abilities, while the TTSC theory can be utilized to identify stressors that contribute to videoconferencing fatigue and negative outcomes that affect academic

performance. By integrating these two models, researchers can gain a deeper understanding of how the fit between the person and the environment impacts the experience of videoconferencing fatigue, as well as the specific stressors that contribute to this fatigue and their impact on academic performance.

The integration of the Person-Environment Fit model and the Transactional Theory of Stress and Coping can offer a comprehensive framework for studying the relationship between technology overload, technology fatigue, and academic performance in higher education students. The Person-Environment Fit model allows for the assessment of the alignment between the demands of ICT characteristics and students' individual capabilities and characteristics. On the other hand, the Transactional Theory of Stress and Coping helps identify stressors that contribute to technology fatigue and explores the negative outcomes that can influence academic performance. By combining these two models, researchers can gain a more profound understanding of how the match between individuals and their technological environment influences the experience of technology fatigue, identify specific stressors that contribute to this fatigue, and comprehend their impact on students' academic performance.

The objectives of this study are to investigate the factors that contribute to technology overload in the context of blended learning during ICT use, particularly in the post-COVID-19 era. The study also seeks to explore the relationship between technology overload and technology fatigue, validate the proposed model through empirical analysis, examine the impact of technology fatigue on academic performance, and investigate the mediating role of student engagement in the relationship between technology overload, technology fatigue, and academic performance.

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Towards a 3D Printed Acoustic Sensor Inspired by Hair-Like Structures of Insects: A Study of Hair Shape and Size

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Keywords: *trichobothria, 3D print, insects, sensors, bioinspired*

Over ages insects evolved to be smaller and more efficient with several miniature sensing mechanisms reacting to the environment around them. Over the last decades, in-depth biological studies on insects have allowed a better understanding of these sensing mechanisms. The hair-like structures, called *trichobothria* or *trichoid sensilla*, are fascinating mechanisms that allow insects to react to airflow and low-frequency, near field, sound [1, 2]. Nevertheless, it is thought that from this sensing structure, other sensing mechanisms are derived by a change on the hair structure. This includes sensing of odours, acceleration, touch, temperature, as well as a gyroscope-like mechanism [2].

This project proposes the use of advanced 3D printing techniques to create a sensor inspired by the trichoid sensilla of insects. Inspiration comes, in particular, from the sensilla structure of the caterpillar *Barathra brassicae* [3], and one from the crickets previously studied in the EU CILIA project [4]. The focus is on developing a mechanical structure that responds to sound; while having in mind future iterations that can sense other phenomena (odour, temperature, etc.). 3D printing allows for faster and less wasteful prototyping compared to other sensor production techniques. Moreover, 3D printed sensors do not contain rare earth minerals as they are made of polymer composites. Additionally, the use of high-resolution 3D printing provides opportunities to integrate arrays of the same sensor, as well as different sensory capabilities, within a single structure. Arrays of sensors that react at different sound frequencies allow frequency content measurement of a sound without the need for computationally expensive digital processing techniques, i.e., it would be more power efficient. Lastly, small sized, efficient sensors such as the one proposed in this project would be perfect for systems devoted to environment monitoring and other sustainable solutions.

Currently, series of sensors with different hair shapes (squared and cylindrical) and sizes are being tested. The ideal response of the hair to sound would be a cantilever-like movement, as this could easily be converted into an electric signal. It was found that thickness (or diameter) and length of the hair were the main parameters that controlled the sound frequency at which the sensor reacted (resonant frequency). It is still unclear if the wideness of the hair changes the resonant frequency substantially. Introducing ridges or rougher textures on the hair shape did not seem to impact the response much. The highest displacement was achieved by squared, longer, thicker, and wider hair shapes. In the cases where the hairs were too short (~1mm) no substantial movement was recorded. Future work includes more advanced experiments on the hair sensors described above and a conversion of their mechanical movement into an electric signal. Furthermore, additional hair bases and sensing mechanisms need to be tested, as this diversity already happens in nature across several insects and can be of great inspiration.

I would like to thank for the support the University of Strathclyde, my supervisor Prof Windmill, and Dr Reid for his invaluable help. I would like to thank DSTL for funding this project.

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Improving the Resilience of Wastewater Treatment Plant

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Keywords: *Wastewater treatment, Pollutants, Uncertain events, Resilience, Digital Twin*

Wastewater treatment is a process in which organic and inorganic pollutants from the wastewater coming out of households, industries and road networks are removed before discharging into a river or sea as an effluent. Wastewater treatment has become a popular topic because of the potential environmental issues caused by the undesirable toxic contaminants in the water bodies. In fact, the performance of such plants depends on the amount of wastewater it receives and the concentration of pollutants in it. Wastewater entering the treatment plant goes through physical, chemical and biological processes which makes it a complex engineering system that needs to be maintained and monitored continuously to assure it operates within the required limits.

Uncertain events such as storms, temperature, shock load etc. have the potentiality of severely affect the treatment process of wastewater. For example, heavy rainfall events cause overflow in the treatment plant and drought causes highly concentrated pollutants in the wastewater. As a result, the effluent contaminated with pollutants is discharged into the river which affects the environment, aquatic life and creates public health problems. Not to mention the water company who is responsible for the treatment plant also faces a big financial penalty from the environmental agencies. With the effects of climate change these events are becoming more extreme and frequent.

Resilience is the ability to cope with uncertainty, mitigate the effect of a shock and recover quickly. The aim of this research is to improve the resilience of the wastewater treatment plant by developing a digital twin which is a mathematical and computational model to virtually replicate the real-world physical component, system and process that will help to take robust and risk-informed decision. To develop a mathematical model data is required and data can be missing, incomplete, imprecise. So, it is important to acknowledge this uncertainty in the model. Propagating this uncertainty in the model will give prediction with associate confidence which the operators at the treatment plant can easily interpret and take decision. For example, if there is an early storm warning the treatment plant can be prepared beforehand for processing excess wastewater with or without changing the control parameters.

In summary, this PhD project will develop robust and credible digital solutions that allow to improve the resilience and sustainability of wastewater treatment plants.

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Development of guidelines for improving quality of life in Chinese old neighbourhoods through socio-cultural strategies: the study of a case of Chengdu Ma'an neighbourhood, China

Yaozhong Zhang

***Keywords**: Neighborhood revitalization, socio-cultural environment, humanity, urban*

Chinese Danwei system is created as a particular way of economic development strategy in 1960 and '70s that was each public and private institution would construct their own residential compound centered on where their workplace was. As one of its leftover products, Xiaoqu residential housing (aka Unit-based building) marks a transformation of Chinese residential housing history and culture; its physical form is still there while people's ways of living have significantly changed, especially regarding residents' privacy in daily life. Xiaoqu is the basic unit of an old neighborhood, combining around 10 to 30 individual unit-based buildings, depending on what scale it is. The arrangement of the buildings in a Xiaoqu is in a form that some houses are placed along the perimeter and others are placed in the Xiaoqu's center.

Under the Danwei system, residents were the Danwei employees whose closest friends would be their neighbors. In that period, the residents engaged in socio-cultural activities together, forming a type of Chinese collectivism living concept. However, the Chinese economic transformation and housing privatization have altered this situation, which makes Xiaoqu housing a free trade commodity to be sold to anyone. As a result, the diverse new resided Xiaoqu residents, especially the younger generation, altered the collectivist sense of Xiaoqu living environment through their expression on a wide range of new interests, which gives the neighborhood energy at the same time.

The issue of how to sustain the Xiaoqu housing form in carrying the new socio-cultural environment to encourage the new residents expressing their interest would be a challenge in forming today's neighborhood revitalization policy. However, the current studies have little addressed this part, for example, to satisfy what conditions can an existing type of Xiaoqu open space can carry the informal food market, rather than just importing socio-cultural activities to the revitalized area.

The research aims to explore socio-cultural indicators of quality of life from literature and an in-depth study on a typical case of old neighborhood revitalization, Chengdu Ma'an neighborhood. It will use both qualitative and quantitative research methodologies including literature review, semi-structured interviews, observations, photo-surveys, and Delphi method to collect and analyze data. The research findings may promote the studies on other Chinese cities' old neighborhoods revitalization.

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Decentralised Federated Satellite Network for Satellite-based Emergency Mapping Mechanism

Robert Cowlishaw

Keywords: *Satellite-based Emergency Mapping, Disaster Response Management, Distributed systems, Decentralisation, Federation, Earth Observation, Web3*

The quantity and diversity of stakeholders in space and the satellites they operate is increasing and the current techniques for management of these assets is becoming more complex and ultimately untenable. Two examples where these management challenges can be seen is in Satellite Traffic Management (STM) and Disaster Response Management (DRM). STM becomes complex due to the issues of scalability with current methods of distributing collision alerts, making decisions on these alerts and acting on these decisions as well as geopolitical disputes significantly reducing communication when it is needed most. Satellite-based Emergency Mapping (SEM) is the ability for Satellite Earth Observation data to be integrated into DRM. With more natural disasters occurring around the world and more data sources available for use, current SEM processes are becoming outdated and risk scalability issues in the future and are already slow. It currently takes approximately three days from a natural disaster occurring to the first satellite image being published using Copernicus SEM, reducing the on ground capabilities for coordination and response.

Distributed Web3 technologies bring solutions to some of the problems faced with satellite asset management and has not yet been integrated in any meaningful way. Web3 introduces many technologies such as distributed ledgers, which are commonly called blockchains. They apply cryptography and consensus mechanisms (automatic computer voting) across many users to provide an immutable (unchangeable) source of data that anyone with a computer can access transparently. Smart contracts are another Web3 technology that allows for more complex logic (a program) to be built upon a blockchain. Smart contracts allow for automation of business decisions, for example counting the number of transactions a bank account has made, and the logic can be viewed by everyone due to being built on blockchain and can therefore be seen to be executed fairly. Tokenisation of assets and governance by assigning a cryptographic token to ownership of something (such as a satellite) allows for governance and decentralisation (no central authority) of a system. Applying blockchain, smart contracts and tokenisation together allows for Decentralised Autonomous Organisations (DAOs). These are similar to regular organisations however due to the security provided through blockchain and governance being divided among token holders, the organisation is owned by its users and is extremely hard to deceive or manipulate due to the automated decisions strategies in the smart contracts. Due to the automation from the smart contracts, almost all tasks can be automated and the issue of scalability disappears.

Using a DAO and other Web3 technologies to automate and decentralise STM and DRM will promote trust and neutrality in space operations between all organisations through transparency and DAO security with tokenisation of satellites allowing for fair governance of space for all stakeholders involved. Automation also reduces the issue of scalability and could reduce the time for SEM. These Web3 technologies also encourage decisions to be made without communications with the ground, and therefore nurturing other edge engineering and computing capabilities.

Democratisation of space by augmenting automation, trust, scalability and governance in space asset management using Web3 technologies is the first step towards a federated network of earth-orbiting satellites.

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Inclusive Communities and Policies

Curriculum for Excellence: Whose 'Excellence' is it Anyway?

Joanna Duff

Keywords: *Curriculum for Excellence, Excellence, Policy, Knowledge, Teacher Agency*

Including the word 'Excellence' within its title suggests to all who teaches from, learns from, and interacts with Curriculum for Excellence (CfE) that young people will reach excellence through the Scottish curriculum. Indeed, the curriculum makers were so sure of this that they did not, and in the subsequent narrative refresh have not, defined what they mean by excellence or included this term within policy documents.

This paper will aim to unpack excellence to provide an understanding of the concept of excellence as a goal constructed by society; what knowledge has been included within CfE and who benefits from this inclusion; and consider the 'worth-iness' of this knowledge. Through examining these issues curriculum will be able to be separated from the notion of excellence to instead embolden and empower. In doing so provide opportunity for young people to engage with an ecology of knowledge that allows them to flourish as an individual within a global society.

Curriculum for Excellence was developed from the 2002 National Debate on Education at a time when Scotland was undergoing a political shift from Labour to the Scottish National Party (SNP). Alexander (2003b) found that curricula cannot be separate from politics as curriculum decisions are profoundly political. Scotland's curriculum is not de-linked from political economy nor is its idea of excellence.

Curriculum for Excellence used the Four Capacities (4Cs) to outline what the political economy would like for young people to develop into; however they are measured through attainment and exam results. This reduces students to human capital rather than citizens who are engaged, just and problem solvers. The 4Cs embody the national values of Scotland (wisdom, compassion, justice and integrity) but these have not been updated to represent the increasingly diverse place that Scotland is. Indeed, social justice is an integral aspect of the teaching standards in Scotland, but as technique and efficiency become increasingly important (Huebner, 1966) teachers aren't encouraged to tackle real inequality in their communities. This performativity over pedagogical knowledge highlights that curriculum is a political construct.

Policy makers and academics have thus far given little thought to the use of the word 'Excellence' in the curriculum and this uncertainty has permeated through to learning communities too. Within CfE there has been a move to evidencing the 'output' of student learning rather than ensuring the 'input' into student learning is explorative and challenging (Mayer, 2021). Excellence as a 'neoliberal ideology' removes this curiosity from student experiences and Huebner (1966) finds that it diminishes the relationship between students and their societal context. CfE includes a breadth of knowledge but there is less focus on depth or value placed upon the reality and diversity of students' experiences. Bergh and Wahlström (2018) stated that teachers in their role as professional decision makers can be stifled by policy, meaning that

there is little opportunity for them to engage in depth or an ability to move away from a western-centric approach to knowledge as these judgements are not afforded to them under the current curriculum.

Through this paper it is hoped that a clear understanding can be sought around who is represented by the knowledge chosen to be included within CfE and the importance of teacher agency to enact social justice. Through the promotion of a diverse and socially just curriculum it is hoped that CfE could be de-linked from those in power.

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‘Thriving Cities’: a reality?

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Keywords: *mental health, wellbeing, community initiative, policy, urban*

The purpose of this research is to generate further understanding and knowledge surrounding thriving city initiatives that are emerging across the world. The initiatives have emerged globally from the UK to the Netherlands, the USA to New Zealand. As recent additions to the sphere of public mental health, there is currently little research surrounding them. To garner useful and relevant information a mixed methods approach will be used. Methodologies are likely to include mainstream methods such as surveys and interviews to complement more creative methods such as photovoice and visualisations such as geographic information systems. The cumulation of these methods will provide perspective and insight into the functioning of the initiatives and the lived experiences of those who the initiatives are designed to support and empower. The research, and the topic itself, are hugely interdisciplinary, consisting of historical contexts, aesthetics, geographies, communications, politics, and many more. This means that the topic can be identified with and influenced from an array of perspectives.

At this point in the research, it has emerged that the initiatives do not follow a pattern that would be expected of those which share a namesake. Comparing thriving city initiatives is much like comparing apples to pears. Despite all falling under the 'thriving city initiatives' title, the research has shown that each initiative is adapted to the context of the city which it serves. The identity of the initiatives is inconsistent - if not confusing - to an outsider, with a distinct lack of congruence in methods, governance, and targets. That is not to say the initiatives are not an admirable and impactful attempt at solving real issues that face urban communities. It provides opportunities for international collaboration and knowledge sharing with changemakers across sectors. This involves action from various actors across communities and governing bodies striving for the improvement of mental health and wellbeing for those living in cities.

The outcomes of the research will enable more informed and effective policy decisions regarding urban mental health and wellbeing to be made. It will also provide insight into experiences of ‘outsiders’ in cities and help identify what support they would like and how this aligns with what the initiatives provide and promote. It will explore the sustainability and effectiveness of these city-level, public health interventions. Furthermore, it will attempt to establish whether initiatives that fall under the title of thriving cities have real, tangible impact on communities and on people’s lives, or instead are closer to performative actions that attempt to provide a legitimate service.

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Earth Observation for Human Rights Monitoring

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Keywords: *Satellite imagery, human rights, earth observation, space, sustainable development goals*

Earth Observation (EO) satellites hold a distinct advantage in imaging the Earth's surface consistently and promptly, a feat that cannot be matched by other data sources such as UAVs or in-situ imaging. Satellite imagery has numerous applications in sustainability, particularly environmental research, such as monitoring deforestation, agriculture and greenhouse gas (GHG) emissions. Moreover, the imagery can provide socioeconomic insights, including GDP growth measurements by correlating the artificial nightlight intensity across a region with economic development [1]. Alternatively, it can aid in humanitarian response by ensuring universal access to basic health facilities [2] or providing assistance in the event of a natural disaster or war.

The impartial and timely nature of this spatial data is a crucial criterion for investigating human rights issues, particularly in cases where governments, political entities, or institutions may make false or irregular claims. In such instances, satellite imagery can be used to validate these statements, such as in the case where the Azerbaijani government denied any destruction of ancient Armenian burial moments, called khackhars. However, high-resolution satellite imagery provided otherwise, revealing that the areas were likely destroyed and flattened [3]. EO data provides monitoring capabilities of hard-to-reach or restricted areas to gather pertinent information on an area, such as the Uyghur camps located in China's Xinjiang province [4].

The UN Human Rights Office (OHCHR) created a framework that employs both quantitative and qualitative indicators to map its 14 rights [5]. This framework serves as a methodological tool to determine if human rights have been violated in response to a complaint. While satellite imagery has the potential to provide valuable data to conduct human rights investigations, there is currently no comprehensive literature or research that outlines all the ways in which EO data can aid in providing insights for the OHCHR indicators. Therefore, my research aims to establish all possible connections between these two fields to enable advanced research for future cases. To accomplish this, I will employ a taxonomy approach that identifies all possible satellite imagery types to relevant indicators and considers factors such as imagery resolution, analysis and modelling techniques, and determining if it is an direct or indirect observation.

In cases of human rights violations, EO data has the potential to serve as evidence in legal proceedings. The first recorded use of EO data as evidence in court dates back to a border dispute case in 1986 [6]. Despite the fact that the first use of EO data in court occurred almost 40 years ago, there are currently no established frameworks for standardizing the generation and analysis of EO data as admissible evidence, which has led to the limited of success within legal proceedings. To address this gap,

this project seeks to evaluate existing methods for processing satellite imagery and develop a structured framework for standardization. The resulting process is expected to enhance the admissibility of evidence in court, increase confidence in the evidence among juries and judges, and improve the versatility of EO data presented in court in the future.

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Mental Health Engagement amongst African Migrants in Scotland: An Exploratory Study

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Keywords: *Immigration, mental health,* critical race theory, *intersectionality, stigma*

Migration from the global South to the North is not a recent phenomenon, however research and interventions have not quite addressed the increased risk of mental illness and influencing factors amongst first generation migrants. Various research has also found conditions such as depression, post-traumatic stress disorder and anxiety have been disproportionately high amongst this group. Compounded by the fact that there is higher vulnerability of being "sectioned" under the Mental Health Act in the UK for black African and Caribbean people, this area of research needs urgent attention. The purpose of this research was to explore factors affecting mental health engagement amongst African migrants living in Scotland.

This qualitative study collected data online during lock down in 2021. This involved two focus groups (18 people in total) and 20 African migrants with lived experiences and indirect experiences of ill mental health. The concepts of Critical Race Theory and Intersectionality were used to analyse the various structural and individual barriers such a systemic racism and cultural norms, that African migrants found to impact their engagement with mental health support.

The findings illustrated that the main theme on stigmatising perceptions, attitudes and language held before migration intersected with anti-immigration discourses and racialised experiences post migration. The lack of a safe space to discuss mental health on a personal and institutional level for this group appeared to perpetuate barriers to help-seeking before ill mental health. The key contribution of this research is developing nuanced understandings on the help-seeking barriers existing in the context of the African migrant experience in Scotland. By tracing the participants' experiences from pre to post migration, this research demonstrated the intersecting social, cultural and political conditions that sustain mental health disparities in this group. These findings show that help-seeking for mental health in this group is not influenced by behavioural patterns but rather larger societal and systemic contexts that should be taken into consideration in future interventions.

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Impactful Entrepreneurship and Innovation

Improving Industrial Inspections with High-frequency Flexible Ultrasonic Kelpie Arrays

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Keywords: *High-frequency array; flexible array; complex geometry components; Ultrasonic NDE; Coded excitation*

High frequency (>15 MHz) ultrasound arrays have gained significant attention in recent years for their ability to provide higher resolution images, allowing detection of smaller defects in materials and structures. This helps identify potential issues before they become critical, preventing costly repairs or even catastrophic failure in some cases. However, the limited penetration depth of high-frequency sound waves can hinder the inspection of thicker components, particularly with complex surface geometries. Therefore, an advanced approach to overcome this limitation combining a high-frequency flexible ultrasonic array and specific patterns of excitation is presented.

In this investigation, a novel 20-MHz 64-element 1 mm-element spacing flexible linear array, developed by Novosound Ltd, was evaluated using two different signal excitation techniques to enhance the signal-to-noise ratio (SNR) and sensor performance on flat and complex-geometry components. An arbitrary waveform generator was used to excite the array with these excitation techniques and a pulse compression technique consisting of a matched filter was implemented on received signals.

Preliminary results were acquired with the array deployed on a 20 mm-thick flat aluminium sample with sided-drilled holes. An SNR improvement of over 65% for the backwall refection compared to a conventional pulse excitation was observed. The array offers flexibility to conform to complex-geometry surface profiles (Figure 1). A curved sample, representative of piping found in nuclear industry, was next

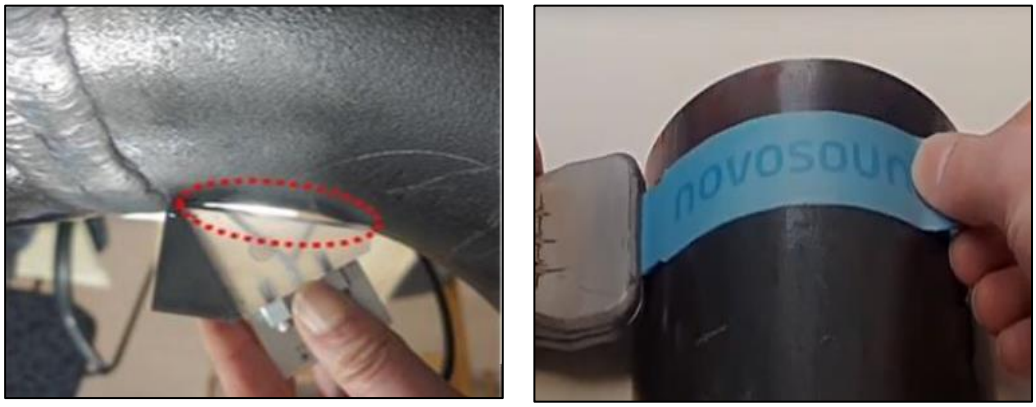

Figure 8: Problem in surface contact with a conventional rigid wedge transducer (left) (Lim, Kim, Cho, & Park, 2022). Demonstration of the flexible Kelpie array inspecting a curved component (right).

investigated using both direct coupling and through an attenuating rubber material, that is suitable to scan the array over rough surfaces. For all experimental scenarios, both excitation schemes were optimised and compared in terms of capability for defect detection.

This innovative transducer system approach has the capability to enhance the efficiency, accuracy, and reliability of industrial inspection. What makes this approach particularly noteworthy is its potential translation to medical ultrasound, thus bridging the gap between the two seemingly disparate fields.

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Investigating the Influence of Entrepreneurship Education in Micro-businesses Growth Owned by Omani Women Entrepreneurs in Rural Areas

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Keywords: *Entrepreneurship, Entrepreneurship Education, Women Entrepreneurs, Microbusinesses, Oman*

This research analyses the role of entrepreneurship education in developing microbusinesses owned by Omani women by examining the current entrepreneurial sources and their effects on micro-enterprises. This study contributes to the existing knowledge by exploring two main points. The first contribution is identifying the role of entrepreneurship education in impacting business performance among rural women entrepreneurs. The second contribution is identifying the role of entrepreneurial intermediaries in boosting entrepreneurship education in rural areas.

Entrepreneurship awareness is usually associated with entrepreneurship initiatives and entrepreneurship education programs offered by academic and business institutions. In Oman, there are eight entrepreneurship initiatives and three business centres. However, all initiatives are based in Muscat Governate, and only 2 out of 6 centres operate in other Governates even though 67% of companies are based outside Muscat Governates. Though it is still difficult for some rural areas to access these services. These initiatives target similar groups such as jobseekers, high school graduates, university students, and post-graduates. This makes the lesser-educated individuals who want to start a business more entrepreneurially vulnerable and not exposed to the same knowledge and experiences as their counterparts.

Furthermore, 28% of Omani female youths (18 – 29 years old) are entrepreneurs. These women entrepreneurs intend to run micro-businesses in female-related sectors such as tailoring, handcrafts, retailing, home-based business, selling readymade garments, and weddings video- and photo-shooting, just to name a few. In Oman, no entrepreneurial initiatives target women entrepreneurs exclusively except those organised by Omani Women Associations (OWA). These initiatives mainly held in the city centre. The literature demonstrates that women entrepreneurs in rural areas lack entrepreneurial knowledge and accessibility to entrepreneurial facilities. Therefore, that hinders them from thriving and scaling up their current businesses.

Despite the significant relationship between entrepreneurship education and business development, there has been no research on the impact of entrepreneurship education on microbusinesses in Oman. To that end, this research bridges entrepreneurial initiatives and microbusinesses and examines the practice of entrepreneurship education.

The research targets two segments which are women entrepreneurs and organisations (e.g., academic institutions, incubation centers, and Omani Women Associations). Choosing women entrepreneurs was based on their living areas,

focusing mainly on rural areas. The data was gathered through three main stages using mixed methods; survey and observation, interviews, and focus groups.

This abstract covers the main findings of all three phases. The results revealed that the main entrepreneurial sources rural women entrepreneurs rely on to run their businesses are online, offline, and personal sources. The latter is the top source. Women operate their businesses based on knowledge from family, friends, and personal experience. More than half (55%) of respondents claim they depend on these sources to run their business. This is due to several challenges these women face, such as location, mobility, society, skills, and regulations. The second top source is online sources, where more than 27% of participants depending on the internet to educate themselves entrepreneurially. These women attend online courses via Zoom, WhatsApp, and Instagram platforms and watch YouTube videos as a source to obtain knowledge due to the above-mentioned challenges. The last source is offline sources, where rural women attend onsite courses and participate in exhibitions and entrepreneurial programs. Utilising all or some of the above-mentioned sources has impacted the businesses positively and, in some cases, there was no significant impact. The positive impacts can be classified into three angles. The first angle is that the businesses received extensive exposure, leading them to scale up (e.g., sales, client base, and knowledge/experience) and show a strategic change (e.g., management, planning, operation, and marketing). The second impact is connections in which the entrepreneurs have formed networks with other entrepreneurs and collaborate with businesses such as café and hotels to sell their products. Additionally, entrepreneurship education helped rural women entrepreneurs improve their personalities and skills. On the other hand, some entrepreneurs did not notice any impacts of attending or using entrepreneurial sources.

The implications of this research are centered around the individual level and expanded to the societal level. This research will help women business owners scale up and operate their businesses based on solid entrepreneurial knowledge.

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Healthier Humanity

Utilisation Trends and Expenditure of Lipid-Lowering Therapies in Kuwait between 2012 and 2022

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Keywords: *Drug Utilisation, costs, cholesterol, lipid-lowering therapies, Kuwait*

Background: Heart and circulatory diseases are the leading cause of death in Kuwait. One of the major risk factors associated with the heart diseases is elevated cholesterol. European guidelines recommend lowering cholesterol as low as possible to reduce the risk of heart diseases. Lipid-lowering therapies (LLTs) are medications that lower cholesterol levels, and they can be categorised into oral and injectable forms. Oral LLTs include statins, the cornerstone therapy, and other non-statin drugs. Injectable LLTs include proprotein convertase subtilisin/kexin type 9 inhibitors (PCSK9Is). PCSK9Is are indicated when there is suboptimal control of cholesterol levels when using oral therapies. Despite their positive impact on heart, they considered relatively expensive drugs. Therefore, it is important to understand the utilisation trends of all LLTs and how they have affected Kuwaiti healthcare spending, especially PCSK9Is, when there is lack of data in this regard. Consequently, this helps to assess the appropriateness of prescribing to achieve optimal patient outcomes.

Methods: This study used an electronic system of the Central Medical Store, the main and only supplier of drugs in Kuwait, to extract data for the supply and costs of LLTs between 2012 and 2022. Both oral and injectable LLTs were included in the study. The extracted datasets include drug name (generic/brand), strength, unit (table/capsule/pen), supplied quantities (annually), and costs. Annual utilisation patterns and expenditure were stratified by LLTs class and individual medicine within each class. The utilisation trends and expenditures for LLT classes were measured using number of items supplied/1,000 inhabitants and total cost of items supplied/1000 inhabitants, respectively. Data were analysed using Microsoft Excel.

Results: Oral LLTs were highly utilised over the study period as there was an increase in the number of items supplied/1,000 inhabitants from 12,793 in 2012 to 20,601 in 2022. The total cost of oral LLTs supplied/1000 inhabitants was increased from £4451 in 2012 to £8741 in 2022. For injectable LLTs, PCSK9Is were highly utilised between the years 2017 and 2022 as this class was initiated in Kuwait in 2017. There was an increase in the number of items supplied/1,000 inhabitants from 4.5 in 2017 to 44 in 2022. The spending on this class was also risen as the total cost of PCSK9Is supplied/1,000 inhabitants had increased from £1583 to £7557 within the same study period.

Conclusion: The increasing use of LLTs is expected as they used for preventing and treating heart diseases but will eventually lead to more costs. This encourages to

control the pharmaceutical consumption and expenditure through supporting clinicians in their prescribing decision marking.

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Virtual Reality Soundscapes for Audiology Diagnostics

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Keywords: *Hearing Loss, Virtual Reality, Paediatric Assessment, Telemedicine, Audiology*

There are approximately 11 million people with hearing loss within the UK, with more than 50 thousand cases encountered in children (Rashbrook and Perkins, 2019). When onset hearing loss occurs during the early stages of childhood and goes undetected, the lack of exposure to environmental sounds and the difficulties in communication with peers can contribute to neurodevelopmental disorders, such as Attention Deficit Disorder, Autism Spectrum Disorder, and to general social and behavioural developmental delays (Barker et al. 2009).

The ability to localise sound is essential for resolving binaural cues and effectively listening to sounds in noisy environments, such as voice in a crowded room (Kerber and Seeber, 2012). Current tests for sound localisation rely on direct patient input and on the patient's ability to comprehend speech, making them unsuitable for assessing young children and people with limited understanding of the English language. Additionally, the test setup is very expensive and bulky, accessible to tertiary care only.

This primary objective of this project, co-funded by Medical Research Scotland and by Cochlear Europe Ltd., is to bypass the main limitations of current testing by designing a sound localisation test suite delivered entirely through virtual reality and/or a pair of headphones. Therefore, by reducing the size, cost, and logistic constraints required by the equipment, sound localisation testing would become available in smaller clinics or directly in the patients' homes.

However, sound direction perception is an emerging research field, and not all factors that affect localisation tasks are known. Therefore, to be able to accurately reproduce real-life sound in a virtual environment, this project also aims to investigate the variables that affect sound localisation using the audiology and acoustics resources located at the Brownlie Digital Health Laboratory of the Department of Biomedical Engineering of the University of Strathclyde. Additionally, an assessment of commercially available sound spatialization engines and plugins will be performed by comparing their performance to real life setups.

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Metal-Organic Framework Adsorbents for Enhanced CO2 Capture and Utilization in Micro-Algae Cultivation Systems for Water Treatment

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Keywords: *Carbon capture and utilization (CCU), Metal-organic frameworks (MOFs), Microalgae-based systems, Wastewater treatment, CO2 utilization efficiency.*

The field of carbon capture and utilisation (CCU) involves capturing carbon dioxide (CO2) emissions from industrial processes and converting them into valuable products or fuels. CCU has the potential to reduce CO2 emissions and contribute to mitigating climate change and creating a more sustainable future. At the same time, wastewater treatment processes (WWTP) considered as very energy intensive operations, requiring water to be pumped, treated, and discharged, which would be responsible for high CO2 emissions [1]. Among all of WWTPs, Microalgae-based systems have been identified recently as one of the potential solutions for Integration of wastewater treatment and CO2 utilization (i.e., coupled CCU-WWTP), whereby the CO2 and dissolved waste (e.g., dissolved Nitrogen & Phosphorous) are main food sources for their algae cultivation cultures [2]. However, current systems face challenges such as low levels of CO2 dissolved within the water, and thus insufficient mass transfer of CO2 bubbles to the culture, which negatively impacts microalgae growth and the overall efficiency of this technology [3]. Here we overcome this limitation by developing a new material that can controllably and reversibly adsorb and release quantities of CO2 required for the sustained operation of microalgae systems towards an efficient coupled CCU-WWTP. We achieve this by designing, and characterization of a new stable metal organic framework (MOF) adsorbent material.

MOFs are highly porous materials composed of metal ions or clusters connected by organic ligands, exhibiting remarkable surface areas. Current work focuses on elimination of contemporary CO2 injection methods and replacement the system aiding modified MOF adsorbent as a new source of CO2 generation. This new amine modified MOF adsorbent has the potential for better CO2 adsorption and regeneration and a solid structure for applying in water treatment systems. Compared to previous studies, our results demonstrate a significant improvement in CO2 utilization efficiency by developing a stable MOF adsorption material that can be applied in realistic scenarios for microalgae-based CCU systems. All previous efforts focused on overcoming the limited dissolved CO2 in the culture of the microalgae cultivation systems (e.g., enhancing mass transfer coefficient for CO2 bubbles), are yet to propose a comprehensive solution for it. In a broader context, our study contributes to the field of CCU by providing a new approach to addressing the challenge of limited CO2 availability in microalgae-based systems for wastewater treatment. The development of more efficient and sustainable CCU systems can potentially have significant environmental and economic benefits, and our findings can pave the way for further research in this area.

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Computational Analysis of Antibacterial Interactions in Lipid-Based Nanoparticles

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Keywords: *Antibiotic activity, Antibiotic resistance, Lipid-bacteria interactions, Lipid nanoparticles, Molecular dynamics simulations*

Antibiotics are drugs that have the ability to kill bacteria or prevent them from growing. This has given them an important role in keeping people healthy – both directly through treating infections in humans, and indirectly by preventing contamination of food supplies. The benefits antibiotics provide humanity are increasingly becoming at risk due to the rise of antibiotic resistance (the ability of bacteria to stop responding to antibiotics) which has made bacteria harder to kill, especially if the organisms become resistant to multiple antibiotics. Some bacteria naturally resist certain antibiotics due to their genetic make-up, however an increasing number are resisting antibiotics they were previously susceptible to. The rate of resistance to antibiotics is largely driven by their misuse in medicine and agriculture as antibiotic resistance is associated with natural selection brought about by exposure of bacteria to antibiotics (Figure 1).

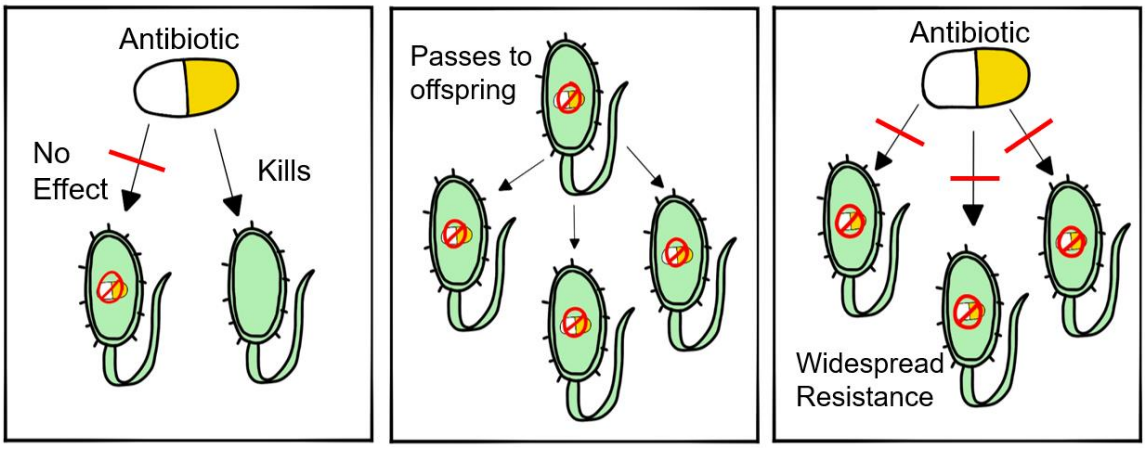

Figure 1. Selection of antibiotic resistant bacteria within a population

Antibiotic resistance has been considered a “fundamental threat to human health, development, and security” by the United Nations since 2016. Globally an estimated 4.95 million deaths in 2019 were associated with antibiotic resistance, with this death toll projected to keep rising if the issue is not addressed [1]. Researchers have attempted to solve this issue by discovering new drugs that can kill bacteria, however this has been difficult due to the ongoing “arms race” between the development of new antibiotics and the evolution of resistance to them, and many antibiotic drugs also

being harmful towards humans and animals. As such, research in this field has increasingly turned towards alternatives to traditional antibiotics.

In this study we aim to investigate lipid nanoparticles (LNPs) as an alternative antibiotic strategy. Lipids are fat molecules which can be mixed together under specific conditions to create tiny particles (LNPs). LNPs can be used to overcome some types of antibiotic resistance by delivering antibiotics in smaller doses directly to the bacteria, and some are even able to kill bacteria themselves if certain lipids are used in their design. While the way LNPs act is still uncertain, there is little-to-no resistance towards them observed in bacteria, making them a promising new alternative to traditional antibiotics.

This research aims to discover how LNPs interact directly with bacteria, particularly in the context of producing antibiotic activity. This builds on previous research in this field and is conducted in collaboration with ABITEC Corporation, a world leading specialist in lipid manufacturing and development, and their sister company, animal feed specialists AB Vista Ltd.

To address the aim, the methodology of this research utilises computer simulations to view and analyse LNP interactions with various bacteria. Computational simulations produce realistic virtual models of known molecules (such as lipids) over fractions of a second. These simulations allow analysis of interactions at atomic levels, which is often impossible to reproduce in a laboratory, making them an invaluable tool for this type of research. These simulations are also customisable, allowing us to change the lipids used in the LNPs to assess their different characteristics, for example ability to penetrate the bacteria. This method is also relatively fast and inexpensive, allowing analysis of a large range of different LNPs.

It is anticipated that this research will prove invaluable in enhancing the design of new lipid-based formulations that can be applied in animal feed, primarily in the pig and poultry industry. In addition, knowledge gained of the mechanisms behind lipid antibiotic activity will help inform the design of future lipid-based antibiotic alternatives. This would provide significant benefit to human health by providing an alternative to traditional antibiotics in the face of a growing antibiotic resistance crisis.

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Software to aid in DNA-Ligand Structure Determination Using Solution NMR and Restrained Molecular Dynamics Simulations

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Keywords: *Drug Discovery, NMR, Molecular Dynamics, Structure determination, Software*

Introduction. Understanding the structure and dynamics of DNA-ligand complexes in solution is valuable in designing novel drug-like scaffolds. For example, structural information of minor groove binders is key to optimising the DNA binding domain of artificial transcription factors used in treating triplet expansion diseases. Coupling solution NMR with molecular dynamics simulations provides a powerful method for structural characterisation, but the complexity of the calculations and their dependence on model parameters can be a barrier to adoption.

Aims. Our aim is to transform the manual step-by-step NMR analysis process into a seamless start-to-finish uninterrupted calculation, in order to expedite the elucidation of DNA-ligand atomic coordinate ensembles.

Methods. We present a software package that combines readily available tools to automate NOESY intensity-to-distance analysis and couple it with the AMBER molecular dynamics program. The software package reduces unnecessary user interactions such that key inputs can be defined at the start of the workflow. CPU parallelisation reduces the NOESY-to-distance calculation time enabling users to receive live data during the assignment process. A template with default parameters and a tutorial on how to incorporate the workflow in your NMR analysis is presented.

Results. The application of the software is demonstrated for a palindromic dodecamer DNA duplex in complex with a novel iPr-polyamide ligand. The impact of NOESY restraints on the simulated structure of the DNA-polyamide complex is illustrated by contrasting a restrained and an unrestrained molecular dynamics simulation. The other factors that impact reproducibility of the NOESY intensity to distance conversion workflow are discussed.

Conclusion. The automated NOESY-to-distance analysis improves reproducibility and enables scalability of the process. Precious user time is reallocated from terminal manual interaction to expert analysis of the results. The tool is provided as open-source software and can be incorporated into NMR assignment software (e.g. Sparky) to aid the assignment process.

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Development of an Organ-on-a-Chip model of human vascular aging

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Keywords: *Cardiovascular Disease, Medial Arterial Calcification, Smooth Muscle Cells, Organ-on-a-Chip, Microfluidics*

With increasing age, the risk of cardiovascular diseases such as strokes and heart attacks increases. This is due to many different factors such as plaque build-up or medial arterial calcification, which can increase arterial stiffness. Medial calcification is driven by the aging process and can be enhanced by diseases such as chronic kidney disease and diabetes.[1]

Medial calcification is the result of the smooth muscle cells (SMC) within the medial layer of the arterial wall undergoing processes similar to bone formation. Continuously high levels of calcium phosphate due to increasing age or disease can cause certain inhibitors within the cells to be inactivated.[2] This results in vascular smooth muscle cells (VSCM) undergoing phenotypical changes to cell types similar to cells commonly found during bone formation processes.[3]

However, the exact morphologies of this type of calcification are still unknown. Due to this, there are no specific causes of this disease identified, neither are there any treatment options available. Creating a functional and easily reproducible *in vitro* model to replicate the changes VSCMs undergo during medial calcification could allow for a deeper understanding of this disease. Furthermore, the model can be used for drug development and testing. Gaining a deeper understanding of the potential causes of medial calcification and developing possible treatment options are a big step towards reducing medial calcification as a risk factor contributing towards severe cardiovascular diseases such as strokes and heart attacks.

The electrospinning technique used to develop the basis of the microfluidic device is a comparatively simple and cost-efficient technology accessible by most laboratories. Furthermore, it allows for easy and appropriate upscaling, making it suitable for production on an industrial scale. This would allow the developed model to be recreated and reproduced for many different research applications in disease modelling and drug screening tests.

In this study a reverse engineering approach to the development of the chip model is taken. Hence, the cell culture model of calcifying VSMCs in common 2D culture conditions has been established. A cell seeded electrospun gelatine membrane has been created, attempting cell alignment along the membrane fibres to model the native VSMC structure. This will create the basis for further development into a functional Organ-on-a-Chip model.

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Does Pharmacologically-induced Depression Exacerbate Alzheimer's Disease Pathology?

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Keywords: *Alzheimer's Disease, neuroinflammation, depression*

Alzheimer's disease (AD) represents a major health burden worldwide, with no cure and limited treatment options. Recent research has focused on targeting amyloid plaques or developing symptomatic therapies however, treating patients with cognitive impairment may be too late due to the extensive amyloid burden. There is a need to focus on individuals who pose a high risk of developing of AD to enable an earlier treatment intervention, thereby preventing, or delaying the onset of cognitive symptoms. Depression represents one of the highest modifiable risk factors for AD, and patients with AD have demonstrated significant benefits of anti-depressant treatment. However, a third of patients suffer treatment resistant depression, therefore, there is a need to identify new intervention targets. Neuroinflammation underlies both diseases and has been theorised as a potential driver of disease. Both, AD and MDD patients, have demonstrated symptomatic and pathological benefits of anti-inflammatory treatment. Identifying targets which contribute to the neuroinflammatory response could offer a new preventative avenue for intervention. PAR2 has been recognised as a contributor in various inflammatory diseases and may be important in the balancing of neuroprotective versus neurotoxic immune response. Furthermore, PAR2 agonist, AC264613, has demonstrated both inflammatory and depressive-like symptoms in vivo. Therefore, this study will determine whether pharmacologically-induced depression exacerbates amyloid pathology in the 5xFAD mouse model, thus accelerating the progression of AD. 10-week-old mice (5xFAD+ and 5xFAD- littermates) were injected with either PAR2 agonist, AC264613 (AC: 100mg/kg i.p), lipopolysaccharide (LPS: 0.5mg/kg i.p) or vehicle control (i.p) and locomotor activity, anhedonia and apathy investigated 2hr and 24hr post-injection using the open field test, sucrose preference test and the splash test, respectively. Amyloid plaque load and blood cytokine levels will be examined using immunohistochemistry and ELISAs, respectively. Following the single intervention, prolonged depression-like behaviour will be explored through multiple doses of AC and LPS in 4-month-old 5xFAD mice to examine if induced extended depression-like behaviour correlates with accelerated AD pathology. In conclusion, this study will determine if pharmacologically-induced depression accelerates AD pathology and therefore, if depression could act as an early biomarker and intervention target for AD treatments.

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Architectural Provisions Supporting the Safe Navigation of Older People with Sensory Impairment (Opwsi): A Scoping Review

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Keywords: *navigation, older adults, visual impairment, hearing loss, design for ageing*

Introduction: The ability to navigate through the physical environment daily is an essential prerequisite for any individual seeking independence in life including older adults. Moreover, vision and hearing are two key senses used for navigation and wayfinding in the environment (Health Facilities Scotland, 2007) and decrements in these senses as part of the normal ageing process make it more challenging for older adults to navigate various environments (Bosch and Gharaveis, 2017, Marquez et al., 2017). This reduces their independence and social inclusion (Walford et al., 2011) and greatly impacts their quality of life. Built environments (including domestic, healthcare, and urban environments) need to be designed in such a way that considers and compensates for declining navigation abilities and minimize spatial disorientation in older adults (Smith et al., 2019). Therefore, a scoping review is required to identify the state-of-the-art architectural principles, guidelines, and strategies in this area to be able to improve the inclusiveness and accessibility of built environments for older adults. As there is a fair amount of literature on cognitive impairment and dementia, this research will focus on visual and/or hearing impairments.

Aims: The scoping review is being conducted to systematically map the knowledge of the practices and strategies supporting the navigation for older adults with visual and/or hearing impairment in the built environment and to identify any existing gaps in knowledge. The scoping review aims to address the following questions:

1. What design principles or strategies have been used to facilitate the navigation of OPwSI?

2. Which standards, legislations or policies are targeting the issue of navigation for OPwSI?

3. To what extent are these principles and policies accommodating the needs of the target group?

Methods: The scoping review will be conducted in accordance with the latest edition of the JBI methodology for scoping reviews (Peters et. Al. 2020). A full search using all identified keywords and index terms will be conducted in 6 databases (Medline [Ovid]; Embase [Ovid]; APA PsycInfo; Art, Design & Architecture Collection [ProQuest]; SCOPUS; and Web of Science [Core Collection]). Grey literature will be included based on the inclusion criteria, to minimize publication bias. After collating all the information, the titles and abstracts will be screened against the inclusion criteria and then the full text of included studies will be assessed in detail. A data extraction

form will be used to synthesize and interpret the data according to its relevance to the review questions. Finally, the findings of the study will be presented in a form of narration and description.

Findings: The review is ongoing at the time of writing this abstract and there is no result available.

Impact: The findings of this study will illustrate the architectural strategies used for designing more inclusive built environments for older adults with sensory impairments. This can inform the policy makers and architects to consider their requirements and limitations in the design and/or planning stage. Having more accessible environments, reduces the level of stress in older adults and helps them live more independently. Moreover, as previous studies suggest (Health Facilities Scotland, 2007), an environment developed with the needs of people with sensory impairments in mind will also be a much easier environment for all users to navigate.

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Quantification of Blood Flow Index in Diffuse Correlation Spectroscopy Using a Robust Deep Learning Method

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Keywords: *Deep learning, blood flow, diffuse correlation spectroscopy, DCS*

Diffuse correlation spectroscopy (DCS) is a powerful non-invasive optical technique to measure the blood flow index, which is approximately proportional to the absolute blood flow. This paper presents a deep learning architecture with one-dimensional neural networks, called DCS neural networks (DCS-NET), for fast analyzing intensity autocorrelation curves. For model evaluation, the DCS data at different source-detector distances (5, 10, 15, 20, 25, and 30 mm) were generated by Monte Carlo simulations on a three-layer brain model and then processed by DCS-NET. The results show that the analysis speed and accuracy of DCS-NET are significantly improved compared with Levenberg-Marquardt optimization, more than 37-fold faster and 8-fold more accurate. Also, compared with the existing two-dimensional convolution neural networks, it shows 140-fold quicker in network training. Moreover, the proposed approach has great potential in hardware implementation, promising continuous real-time blood flow measurements.

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The Effect of Bile Salt Micelles on Diclofenac Sodium Solubility in Fasted State Simulated Media

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Keywords: *Diclofenac sodium, Solubility, Biorelevant, Micelle, Dynamic light scattering, Fasted state.*

Orally administrated drugs are the most common route of administration as 70 % of drugs are taken orally because it is convenient for patients and industry (Khadra et al., 2015). Drug solubility is the main parameter for drug development in early stages. It is essential to predict drugs solubility in our gastrointestinal fluid as it will affect the bioavailability of the drug, therefore, its therapeutic effect. Drug bioavailability must exist within drugs therapeutic window to avoid undesirable effect and reduced efficacy.

Understanding these components and their role on drug solubility is essential to predict the right therapeutic range for drug needed to achieve the desire healing with minimum side effect. To achieve this, the ideal situation is to characteristic human gastrointestinal fluid, however, this is not easy and not always applicable. So, simulated intestinal fluids based from human fluid analysis is the suitable option for experimental studies (Parrow et al., 2023).

The solubility of oral drugs is influenced by many factors such as drug characteristic and intestinal fluid components. Bile salts, phospholipids and free fatty acid consider as solubility factors forming structure called micelle. Micelles present in gastrointestinal fluids play a major role in oral drugs solubility and have an influence on drugs with poor solubility (Parrow et al., 2020).

The aim of this study is to characterise these colloidal structures and to investigate if they have any role on diclofenac sodium solubility in fasted state simulated intestinal fluid (FaSSIF) by comparing these results to diclofenac sodium solubility in phosphate buffer without intestinal components.

Two media were prepared for fasted state (FaSSIF-V1, FaSSIF-V2). FaSSIF-v2 has lower (lecithin, bile acid) ratio and flask shake method was used. Dynamic light scutter (DLS) was used to measure the average size (d. nm) of micelles before and after diclofenac sodium loading. Microviscosity meter was used for viscosity measurements. HPLC was used to measure diclofenac sodium equilibrium solubility in these three simulated media.

The average size of micelles in both of FaSSIF-V1, FaSSIF-V2 was significantly increased after diclofenac loading from (91, 96 nm) respectively to (500, 552 nm) and the population of micelles changed from one fraction before drug loading to more than one population with an incasement in polydispersity. The solubility of diclofenac sodium in phosphate buffer was higher than both FaSSIF-V1, FaSSIF-V2 media with (6.68, 1.71, 2.15 mg/ml) respectively. These results show that diclofenac sodium does not rely on micelles for its solubility. This study suggests that the role of micelles in drug solubility as surfactant may vary depends on the natural of the drug.

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Neuropsychiatric Clusters of Symptoms in Alzheimer's Disease and Mild Cognitive Impairment Over Time

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Keywords: Alzheimer's disease, Mild Cognitive Impairment, Neuropsychiatric Symptoms, Factor Analysis

Alzheimer's disease (AD) is the most common form of dementia, affecting 35 million people worldwide. It presents with different clinical features, including progressive cognitive impairment and decline in the ability to perform daily life activities, and neuropsychiatric symptoms. Neuropsychiatric symptoms are highly prevalent along the continuum of the disease, including at the stage of Mild Cognitive Impairment (MCI), and at times they can even precede cognitive decline. Importantly, they are associated with increased distress for the individual and their families, poorer disease outcome, and greater risk of hospitalization and death.

Neuropsychiatric symptoms tend to vary in their presentation both between, and within individuals across the course of the disease; this has contributed to the challenge to investigate them individually in clinical practice, and the effort to investigate the patterns of their co-occurrence, which is still matter for debate. This constituted the rationale for our study, as we aimed to investigate the factors underlying neuropsychiatric symptoms and how they might change over time, in MCI and AD dementia.

The analyses were performed on SPSS (Version 28). Sample size for these analyses was collected from the international database Alzheimer's Disease Neuroimaging Initiative (ADNI), using data from the Neuropsychiatric Inventory (NPI), a care-giver interview which assesses the presence, frequency, and severity of the main twelve neuropsychiatric symptoms. We used data from the baseline assessment visit, followed up until the data recorded at month 72. Sample size included MCI and AD dementia participants, based on ADNI's inclusion criteria for MCI and probable/possible AD (which are based on the NINCDS-ARDRA criteria).

We performed a series of exploratory principal components analyses (PCA), with Varimax rotation, and principal axis factor analyses (FA), comparing Promax and Direct Oblimin rotations, at each timepoint. These statical methods allow to identify the latent factors or themes behind the twelve observable symptoms. The results were interpreted based on the following criteria: their Eigenvalues being greater than one, items' loadings greater than 0.4, patterns of the scree plots, a minimum of 40% total variance explained by the model, and independence of factors (i.e. symptoms loading on only one factor).

The analyses were performed on both the total groups (inclusive of AD and MCI participants), and on the two groups separately, however these were only performed on the earlier timepoints only, due to the availability of the sample. Results from both PCA and FA indicate that a clear structure cannot be identified, as factors are not stable over time; however, some of the symptoms tend to load in the same factors on

most of the measurements, for which we attempted an interpretation as: symptoms relating to mood, affect or hyperactivity (agitation with depression, anxiety and irritability), symptoms relating to hypomania or impulse control (elation with disinhibition), psychotic symptoms (delusions with hallucinations, however the elements of this do not seem to cluster together in MCI) and lastly, although less consistent than the previous ones, symptoms relating to behavioural disturbances (apathy with aberrant motor behaviour, sleep disturbances and appetite disorder).

The available evidence reveals that factors underlying the neuropsychiatric symptoms in a sample of AD and MCI participants present a limited degree of consistency across the time-points. What can be implied from our study which can be useful in the future, is that while a single factor structure could not be identified across the time-points, the co-occurrence of some of the symptoms within AD and MCI should be taken into account in studies that attempt, for example to understand symptom neurobiology, considering the most consistent clusters of symptoms. Similarly, the difference found across the time-points and between AD and MCI suggests the importance of taking into account aspects such as disease stage and heterogeneity of the sample in future studies on neuropsychiatric symptoms.

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Development and Characterisation of Antibacterial Coatings for Orthopaedic Implants

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Keywords: *Orthopaedic implant infection, antibiotic coating, polymer coating, biofilm*

Orthopaedic implants, such as joint replacement protheses and bone fixation screws and plates, can be contaminated with bacteria during surgery, leading to infection. Infection occurs in 2-4% of primary joint replacement surgeries[1], causing patients pain and distress, and increasing hospital bed stays. Treatment is challenging, as the bacteria can form surface-associated communities, known as biofilms, on implant surfaces. Once a biofilm is established, it is very difficult to remove with antibiotics alone, so these infections often require revision surgeries for removal or replacement of the implant. This significantly increases NHS spending, with the average hip joint revision surgery costing an estimated £50,000[1]. As the population continues to age, demand for joint replacement surgery is rising, which makes finding solutions to reduce infection rates a critical concern in orthopaedic surgery today.

One approach to infection prevention is local antimicrobial therapy, where antibiotic drugs are placed at the site of the implant during surgery, to inactivate bacterial contaminants. This can be done with antibiotic-eluting coatings for implant surfaces, but the drug elution profile for this remains to be optimised, and optimisation is critical to the safety and success of this approach. Optimisation of the release profile could be achieved with mathematical (*in silico*) modelling, the first step for which is to characterise release profiles *in vitro,* to generate data which *in silico* models can be based upon.

This study aims to characterise the antibiotic release profile from, and antimicrobial efficacy of, antibiotic loaded polymer coatings for orthopaedic implant surfaces. Three coatings were prepared by mixing solutions of the antibiotic rifampicin (100mg/ml) with the degradable polymer PLGA (100mg/ml), to ratios of 50%, 40%, and 25% rifampicin. Coatings were applied to the surface of stainless-steel coupons (20×5×0.5mm) and submerged in phosphate buffered saline (PBS) at 37°C. PBS was replaced and retained for analysis at intervals ranging from 1 hour – 16 weeks. Drug elution over time was measured with UV-vis spectrophotometry (350nm). Antimicrobial efficacy of the coatings after different drug elution times will be assessed by incubating coated coupons in suspension with *Staphylococcus aureus* for 24 hours, and biofilm formation on the coupons will be enumerated using standard microbiological methods.

The percentage of rifampicin released from each coating was significantly different at all timepoints up to 21 days ($p \leq 0.003$). Coatings with a lower ratio of rifampicin

eluted more slowly: the 25% and 40% coatings continued to elute up to 11 weeks, while the 50% coating had released >99% of its total rifampicin by 7 days. *S. aureus* was cultured on uncoated stainless-steel coupons, with early signs of biofilm formation demonstrated after 24 hrs incubation. All coatings are expected to provide sustained protection against bacterial colonisation within this model. Characterising *in vitro* release of rifampicin from PLGA coatings onto stainless steel will form the starting point from which *in silico* models of anti-infective orthopaedic implant coatings can be developed. These models will allow optimisation of these coatings, leading to a reduction in the orthopaedic implant infection rate, and therefore to a healthier humanity.

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Adapting a Sleep Intervention for Adolescents with Co-Morbid Mental Health Problems and Insomnia: A Delphi Study

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Keywords: *Sleep, Insomnia, Adolescent, Mental Health, Intervention*

Background - Insufficient sleep is highly prevalent in adolescents and has been associated with increased emotional reactivity, physical health problems, poorer cognitive functioning, and academic performance[1-5]. There is high comorbidity between adolescent insomnia and mental health[6]. Cognitive behavioural therapy for insomnia (CBT-I) is the recommended therapeutic approach to treat chronic insomnia and evidence suggest it can significantly improve sleep and mental health[7-10]. Although, due to a lack of awareness and training, sleep issues are rarely addressed in clinical practice, including in Child and Adolescent Mental Health Services (CAMHS)[11-12]. The Strathclyde intervention to encourage good sleep health for teenagers (SIESTA) was developed as a sleep education and improvement programme[13]. SIESTA was designed for delivery to all adolescents, irrespective of the presence of sleep difficulties, therefore, some evidence-based CBT-I techniques were excluded (including sleep restriction and stimulus control). Given the prevalence of sleep problems within CAMHS, there is a clear need for a more targeted intervention for those who experience insomnia and mental health. Therefore, it is critical to adapt SIESTA to ensure that is appropriate for delivery to adolescents with co-morbid mental health and insomnia.

Objective - This study aimed to assess the appropriateness, and to inform necessary adaptations, to the SIESTA intervention to ensure that it is suitable for delivery to adolescents attending CAMHS with co-morbid insomnia and mental health difficulties.

Method - This study utilises a modified Delphi technique to examine expert judgement and consensus on the appropriateness of SIESTA for the target population, method of delivery and intervention content. Seventeen experts were contacted to participate, including academics and practitioners who were experts in behavioural sleep medicine and adolescent mental health. Two rounds of questionnaires were disseminated via Qualtrics. Round one featured 5 open-ended and one multiple choice question. The findings from round one informed the development of the second-round questionnaire. Round two featured 8 closed questions and 2 open-ended questions. The data was analysed using Thematic Analysis, frequencies, and descriptive statistics.

Findings – Seven experts participated in the first round (see table 1 for demographic information). Three main themes were identified and included: SIESTA is appropriate for early-mid adolescents with specific co-morbidities (including anxiety and depression), content and design are appropriate but may require adaptations, session format is suitable and parent/caregiver involvement is necessary for implementation (see table 2). Based on the findings, an adapted protocol was created, and experts were asked about the appropriateness of adaptations including the inclusion of sleep restriction therapy, the number of sessions, and order of components. Additionally, the appropriateness of the intervention for adolescents with Delayed sleep-wake phase disorder and any subsequent adaptations required for these individuals. Also, the delivery of SIESTA by non-mental health experts and information to include in a parent/carer resource. Finally, experts were asked if they would participate in a third round to review the final materials. Data collection for round two is currently ongoing and it is anticipated that round three will be the final round in this study.

Conclusion – To our knowledge, this is the first time that the Delphi methodology has been used to adapt a sleep intervention, therefore, this is a novel and impactful addition to the literature. The findings from round one have been used to inform the development of SIESTA for this new population and context. Upon completion of this study, a study will be conducted to explore the feasibility, acceptability, and preliminary effectiveness of delivering SIESTA to adolescents with co-morbid insomnia and mental health, who are attending CAMHS.

Table 1: Expert demographics

Round 1	
Responses	7
Gender	5 Female
Location	6 Europe, 1 North America
Designation	6 academia, 1 academia and practitioner
Expertise	3 Adolescent mental health 2 Behavioural sleep medicine 2 Adolescent mental health & Behavioural sleep medicine

Table 2: Summary of findings from round 1

Round 1 Findings		
Theme	**Sub-theme(s)**	**Quotations**
SIESTA is appropriate for early-mid adolescents with specific co-morbidities	1. Appropriate for early-mid adolescents 2. Appropriate co-morbidities include	*"a substantial proportion of mental health problems arise before the age of 14 and changes in adolescent sleep occur around puberty. As such, it is likely that those in early*

	mental health difficulties.	*adolescence (i.e., around 11-13) would benefit the most from this intervention"* "Those experiencing elevated symptoms of poor mental health may benefit the most.""
Content and design are appropriate but may require adaptations	1. Content and components of the intervention 2. Design of the intervention 3. Method of delivery and session format	*"May work for some, but not all adolescents."* *"…this age-group likes to 'do' things (more so than think about it)"* *"I think number of sessions depends on the severity of the sleep and mental health difficulties. I would then advise weekly sessions"* *"Definitely include a booster to help tackle any remaining difficulties implementing."*
Parent/caregiver involvement is necessary for implementation	1. Involvement in important, but there may be barriers 2. Method and content	*"Evidence suggests parent involvement is crucial, but this is tricky to obtain"* *"Would be helpful for parents to receive resources to support at home implementation and potentially to attend their own session with the facilitator to receive a summary of what the young person has learned."*

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Design of "Seek-and-Destroy" Nanosized Particles for the Treatment of Prostate Cancer Cells

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Keywords: Docetaxel, nanosized particles, prostate cancer

One in 8 men will get prostate cancer. If you are over 50, or you are Black, or your dad or brother had it, you are at even higher risk. Prostate cancer is now the leading cause of cancer-related death in the UK, claiming approximately 10,000 lives every year. Its incidence kept on increasing during the last two decades.

Although conventional treatments such as surgery, radiotherapy, and administration of anti-cancer drugs can be efficacious against localized tumours, there is still no effective treatment for patients with advanced disease which has spread to other organs. Docetaxel, the anti-cancer drug routinely used to treat advanced prostate cancer, only results in a modest increase in the survival of the patients. Nearly half of these patients do not respond to the treatment and those who do eventually develop drug resistance, leading to treatment failure. New therapeutic approaches are therefore urgently needed for these patients.

In order to remediate this issue, we investigated if the association of docetaxel with other drugs, and the incorporation of these drugs together in nano-sized particles able to specifically recognize cancer cells, could increase the therapeutic efficacy on prostate cancer.

We demonstrated that using docetaxel in association with other drugs was much more efficacious on various types of prostate cancers than using the drug alone. A concentration of the drugs together as small as 1.95 nM was enough to kill the cancer cells.

This combination of drugs was then loaded together in nano-sized particles able to specifically recognize cancer cells.

The "seek and destroy" particles were taken up by 3 types of prostate cancer cells, more than 17-fold more than the drug solution.

The therapeutic efficacy of these particles was increased by more than 70% on prostate cancer cells, compared to what was observed when using the drug solution.

These "seek and destroy" nano-sized particles entrapping an association of docetaxel with other drugs are therefore highly promising.

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Particle Size and Viscosity Analysis of Fasted State Simulated Intestinal Fluid Reflective of In-Vivo Gastrointestinal Variability

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Keywords: *Fasted state; absorption; viscosity*

Introduction: The absorption of nutrients and drugs from the small intestine is largely determined by the amount that can be dissolved in the fluids present in the gut environment. Gastrointestinal fluid is a complex media with many components that is variable depending on the location in the gastrointestinal tract and how recently an individual has had a meal. A range of five simulated intestinal media, representative of the variability observed in a previous study of intestinal fluids taken from human subjects, have been designed to reproduce the small intestinal conditions[1].

Aim: Four poorly soluble drugs (naproxen, fenofibrate, carvedilol and tadalafil) were dissolved in each of the five simulated intestinal fluid media which were analysed by dynamic light scattering and rolling-ball microviscometry to better understand the potential variability in colloidal behaviour in the gastrointestinal environment.

Methods: To create each of the five media, a concentrated stock solution 15 times the mass was prepared of bile salt (sodium taurocholate), phospholipid (soybean lecithin) and fatty acid (sodium oleate) in chloroform. For each of the media recipes, a solution 1500 times greater the mass of cholesterol in chloroform was prepared and an aliquot was transferred to the stock solution. The chloroform was then evaporated off with a nitrogen gas to produce a dry film which was resuspended in 3 mL of water and stirred to create a homogenous mixture. This was transferred to a 5 mL volumetric flask and made to volume with water. Aqueous buffer (sodium phosphate monobasic monohydrate, 28.4 mM) and salt (sodium chloride, 105.9 mM) were also prepared. Excess drug was added to these solutions to produce a saturated solution which was filtered to remove excess drug prior to analysis.

Analysis: Dynamic light scattering is used for the particle sizing of samples. It measures the fluctuations in the intensity of scattered light from particles undergoing random motion. Analysis of these fluctuations in turn yield information on particle size. Rolling-ball microviscometry measures the time taken for a ball to move through a micro-capillary containing the sample being measured and correlates this to the viscosity of the fluid.

Results: The hydrodynamic diameters (particle size) and viscosities were measured for each of the drugs in the five representative fluids and the values obtained can be found in Table 1.

Table 1*: Particle Size and Viscosity Analysis by DLS and Microviscometry. Data shown is mean value from 3 measurements.*

Drug	Simulated Media	DLS Size (d, nm)	Lovis Dynamic Viscosity (mPa-s)	Lovis Kinetic Viscosity (mm^2/s)
Naproxen	1	121.30	0.708	0.7125
	2	50.03	0.714	0.7191
	3	48.45	0.712	0.7170
	4	25.15	0.731	0.7357
	5	7.75	0.763	0.7677
Fenofibrate	1	55.14	0.712	0.7162
	2	31.62	0.725	0.7299
	3	30.72	0.763	0.7686
	4	13.66	0.709	0.7139
	5	8.27	0.757	0.7619
Carvedilol	1	131.70	0.707	0.7117
	2	90.76	0.708	0.7129
	3	58.12	0.707	0.7123
	4	144.13	0.708	0.7129
	5	6.22	0.754	0.7590
Tadalafil	1	67.34	0.714	0.7184
	2	26.86	0.709	0.7145
	3	22.78	0.704	0.7087
	4	59.28	0.710	0.7146
	5	7.12	0.761	0.7661

Differences in the particle size in the simulated media were observed based on the drug present and the fluid used which indicates unique drug-fluid interactions within these systems. Smaller changes in viscosity were observed within the systems examined.

Work is ongoing to characterise the composition of the structures formed to better understand the mechanism that underpins this data. Further statistical analysis is also planned to interrogate the significance of the findings.

Conclusion: This study uses a range of simulated intestinal fluid media that represents the diversity of a real population to show that the particle size and viscosity in the gastrointestinal environment is influenced by the composition of simulated intestinal fluid. The predicted colloidal behaviour of a drug is a key factor to be considered when predicting the drug exposure and formulation strategy for that drug. Further work is ongoing to determine the factors that influence the change in colloidal structures.

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