DOCTORAL SCHOOL MULTIDISCIPLINARY SYMPOSIUM 2022

BOOK OF ABSTRACTS

DRG
Doctoral
Researchers
Group

University of Strathclyde Business School

University of Strathclyde Engineering

University of Strathclyde Science

University of Strathclyde Humanities & Social Sciences

Chairs Welcome

Welcome to **DSMS 2022**! This year we tackle the theme of a changing world!

Recently, we have gone through a time that will go down in history as one of the most disruptive periods for generations to come. The pandemic obliged us to adapt, innovate, and collaborate. Indeed, solving the global challenges, past, present, and future, have, and will continue to require, constant questioning and exploration of the world around us. Where better to find people tackling these challenges than within the postgraduate community, here at the University of Strathclyde?

This year we are proud to host 83 presentations over our three-day event. Fifty-two in-person oral presentations, 14 zoom presentations and 17 poster presentations. From block chain technology to women's rights, robot ethics to next-generation medical design tools, gender differences in social media to inclusive education in Ghana, DSMS 2022 promises to deliver a wide variety of world-leading research. We will also be hosting the final of the world-renowned 3 Minute Thesis® competition for the University of Strathclyde candidates!

We are grateful to welcome three wonderful Keynote speakers: Douglas Hutchison Director of Education for Glasgow city council, Captain Paul Watson, co-founder of Greenpeace and founder of Sea Shepherd and last but not least Dr. Rabia Khan, a pioneer in the Biotech Industry and Biobusiness sector.

We are excited that the event will be taking place in the new Teaching and Learning Building on the University campus. This is a great way for postgraduate students to explore the campus and take advantage of the extensive facilities at your disposal.

I would like to personally thank the wonderful DSMS 2022 Organising Committee who have worked relentlessly for the past year to make this event happen along with the dedicated staff members of the Strathclyde Doctoral School for their continuous support. Thank you to all the PhD (and this year, master) students who submitted their work and to the 140+ peer reviewers who dedicated their time to ensure that each and every abstract reached its full potential. And finally thank you to the 60+ volunteers for their time and efforts to contribute to the smooth-running of the symposium.

I would also like to thank our Gold sponsor Cambrex for their generous support of DSMS 2022.

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

Georgie Crewdson

Chair of DSMS 2022

Contents

DSMS 2022 Organising Committee

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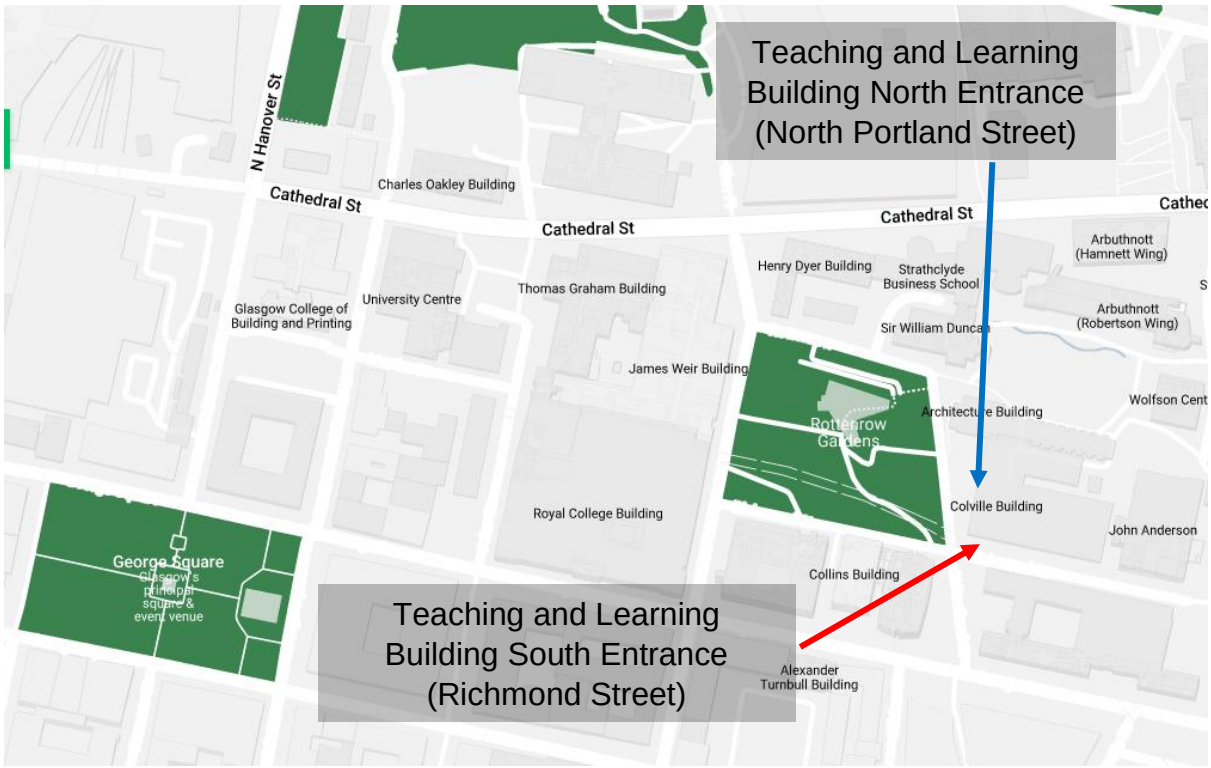
Dr Gabrielle Milson
Strathclyde Doctoral School

Prof. Eleanor Shaw
Strathclyde Doctoral School

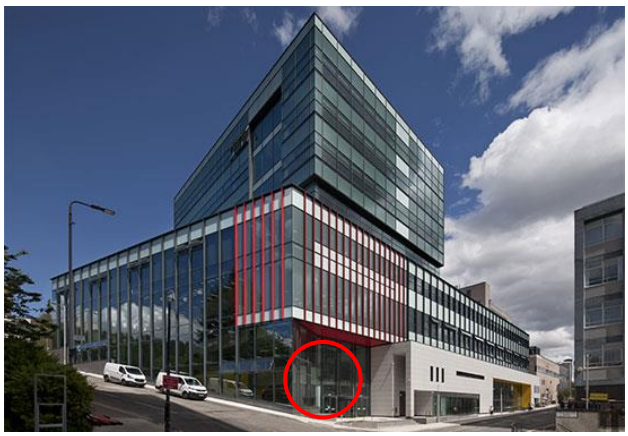
Map and Access

This year, the symposium will take place in the new Teaching and Learning Building on the Universities' campus. The campus is only a 5 min walk from Buchanan Street Subway Station and from Queen Street Station, and a 15-20 min walk from 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 Entrance



South Entrance

Registration

The link to register for the conference can be found here:

To register please click here

If you are attending the symposium in person, and have already registered online via the above link, please collect your name badge from the registration desk in the morning of the day(s) you wish to attend.

If you have not registered online via the above link, you can still attend the symposium by registering at the desk on the day(s) you wish to attend.

If you are attending online, please register online via the above link and simply join the zoom meeting associated with the room you wish to attend. The zoom links can be found here: Zoom Links

Keynote Speakers

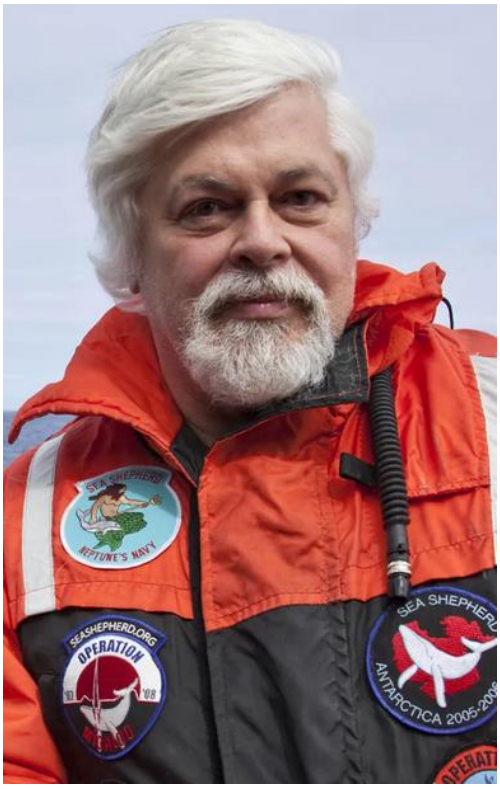
Douglas Hutchison

Douglas Hutchison was a Catholic priest for 13 years and then after leaving the priesthood worked as a secondary teacher of religious education before training and working as a teacher for children and young people with social, emotional and behavioural needs. He then completed the MSc in educational psychology at Strathclyde and worked as an educational psychologist, becoming principal psychologist in South Ayrshire Council.

In 2008 he moved to Her Majesty's Inspectorate of Education working as an Inspector for 5 years after which he returned to South Ayrshire as Head of Education, then Director of Education and Depute Chief Executive. From January 2022 Douglas took up post as Executive Director of Education for Glasgow City Council. He is currently also working on a Doctorate in Educational Psychology at the University of Strathclyde.

Captain Paul Watson

Founder of the Sea Shepherd Conservation Society in 1977 and Co-founder of the Greenpeace Foundation in 1972.



Paul Watson is a master mariner, journalist, author, and lecturer on oceanic conservation activism. A Canadian/U.S. citizen. Studied Communications at Simon Fraser University. Taught courses on deep ecology at Pasadena College of Design and UCLA. Author of numerous books on conservation, history, poetry and for children.

Recognized by TIME magazine as an environmental hero of the 20th Century, recipient of numerous awards for conservation including the Jules Verne Award for Conservation and the Amazon Peace Prize. In 2008 the Guardian cited him as one of the 50 people who could save the planet.

Captain Watson has participated in the production of films like The Cove, Sea of Shadows, Chasing the Thunder, Seaspiracy and Watson. He was also the star of the Animal Planet series Whale Wars for seven seasons.

Today Captain Watson oversees a global movement with 14 ships patrolling the ships intervening against poachers, other illegal activities, collecting marine debris and documenting activities destructive to the ocean.

Dr. Rabia Khan

Rabia Khan, PhD (Immuno Genetics, MBA) is the founder and CEO of Ladder Therapeutics, a YC-backed biotech building the world's first map of the druggable transcriptome.

Prior to founding Ladder Therapeutics Rabia was Managing Director of Discovery Sciences at Sensyne Health where she established the scientific strategy as well as building data science and discovery teams of over 50 personnel and pharma partnerships with Bayer, BMS, Roche and Alexion and others. She also held senior roles at BenevolentAI and Meta (acquired by Chan Zuckerberg BioHub). At Meta, she was pivotal in the partnership with the Intelligence Advanced Research Projects Activity (IARPA) to acquire horizon-scanning technology that used NLP to research the biomedical corpus. At BenevolentAI, she helped shape the discovery strategy for a number of programs, led the Age-Related Macular Degeneration and Glioblastoma

drug discovery programmes and served as the interface between the technical and biological teams under the mentorship of Prof. Jackie Hunter.

Born and raised in Pakistan, Rabia has a passion for encouraging diversity in technology, thought and education, to improve patient outcomes. She was named 50 Movers and Shakers in BioBusiness and 30 Rising Leaders in Biotech 2020.

The Buddy Scheme

We are delighted to pilot the new Buddy Scheme at DSMS 2022

But what is it? And who is it for? And how can I help?

What is the buddy scheme?

The buddy scheme is exactly what it sounds like, it is a way of connecting with a colleague and guaranteeing that you have some company when attending the DSMS. You fill in a short survey, either as someone looking for a buddy or someone who would like to volunteer to be a buddy, and we match you up with someone who also wants to meet someone new and not go to the conference on their own.

Who is it for?

Anyone who wants to attend DSMS 2022 in whatever capacity but for any reason is unsure of attending alone. It may be that:

- This will be your first conference
- You have not been able to connect with your peer group because you started during Covid-19 restrictions
- This is the first event you have been to after lockdown and have some social anxiety
- You have not been to campus before
- You have struggled in the past with understanding conference proceedings booklets and timetables
- You have a disability
- You have a mental health condition
- English may not be your first language
- You may be having a hard time with the registration forms (don't worry just email us @doctoralresearchers-group@strath.ac.uk and we will help you with the buddy one to get you started)

If any of this sounds like you then follow the below links and sign up! If you are unsure if it's for you but would like some more information you can drop us an email.

How can I help?

We are also looking for people who are planning to attend DSMS and would like some company, or have some experience of supporting people in the past, or speak a second language.

Requesting a buddy or volunteering to be a buddy is just a case of following the below link and completing a short form.
https://hass.eu.qualtrics.com/jfe/form/SV_0DQXjNpzoszxj70

PhD Taster Workshop

DSMS 2022 is also hosting a PhD taster workshop on the Thursday 9th June at 14:00pm.

This is a fantastic opportunity for undergraduates, and anyone interested in starting a PhD, to get some answers! Where better to explore the world of research and engage with PhD students than at DSMS? The workshop may also be useful to 1st year PhD students who would like to know more about what to expect during the PhD!

Symposium Schedule

Key	Changing People	Changing Technology	Changing Planet

Poster Presentations (Level 6) - Wednesday 8th June (12:45pm - 13:45pm)		
Iqra Ishaque Memon	Aaisha Rashid Al Badi	Fatima Abbas
Vijayita Prajapati	Ross Urquhart	Alice Shelton
Adel Ali Mohamed Dadaa	Michail Dellepiane	
Saadia Tanveer	Andrew England	
	Hawraa Ali	
	Laure Vidal--Roussel	
	Abdoalhamed Zngeena	
	Alexandra Wren	
	Emily Herd	
	Ini Akpadiaha	
	Jayson John Cheyne	

	Wednesday 8th June 2022				
Room	TL330	TL225	TL228	TL229	SDS Space Level (6)
9:00	Registration			Buddy meet- up	
9:30					
9:45	Seating				
10:00	Chairs Welcome and Message from Prof Eleanor Shaw			Quiet space/ buddy scheme space	
10:15					
10:30	Break				
10:45	Thanyanuch Tantikul	Hamish Swanson	Lívia Dias F. de Oliveira		
11:00	Kenvil Carmelita Souza	Ping Yang - Z	Shayesteh Moghadas		
11:15	Pia Singh	Matthew Berry	Nameeka Shahid - Z		
11:30	Amthal hamad AlOraifan - Z	Laddawan Yaimanee - Z	Alina Ashraf - M		
11:45	Nessresrine Boussaoui	Nouf H. Albehairi			
12:00	Break				
12:15	Keynote TL330 - Douglas Huchiston				
12:30					
12:45					Lunch/ Poster Presentations
13:00					
13:15					
13:30					
13:45	Seating				
14:00	3 Minute Thesis Final (TL330)				
14:15					
14:30					
14:45					
15:00	Break				
15:15	Samantha Francis	Isah A. Jimoh	Pradip Iramdhan Aliyansah - M		
15:30	Eyman Al Riyami - Z	Kieran Millar	Shaun McKnight- Z		
15:45	Sonya Fonweban		Amy (Hyslop) Mavroudis		
16:00	Break				
16:15	Dolly Sunilkumar	Brendan Latham			
16:30	Joanna Holmes	Juraj Sikra - Z			
16:45	Nicholas Novignon	Keely Neave Shand			

Thursday 9th June 2022				
Room	TL330	TL225	TL229	SDS Space Level (6)
9:00			Buddymeet- up	
9:30	Registration			
9:45				
10:00	Seating		Quiet space/ buddy scheme space	
10:15	Barota Chakraborty	Olivia Johnson-Love		
10:30	Lynsey Stewart - Z	Sagar Suresh Kumar		
10:45	David Hunter Scott	Erika Silverman - Z		
11:00				
11:15	Break			
11:30	Tawonga Mwase-Vuma - Z	Jonathan Conn		
11:45	Elita Chamdimba	Kristopher Barr		
12:00	Eunice Adwubi - Z	Laura de Melo Corgosinho		
12:15	Break			
12:30	Keynote TL330 - Captain Paul Watson (Sea Shepherd)			
12:45				
13:00				Lunch
13:15				
13:30				
13:45	Seating			
14:00	Workshops:			
14:15				
14:30	Cambrex (TL330)			
14:45				
15:00	PhD Taster Workshop (TL228)			

Friday 10th June 2022				
Room	TL330	TL225	TL229	SDS Space Level (6)
9:00			Buddy meet- up	
9:30	Registration			
9:45				
10:00	Seating		Quiet space/ buddy scheme space	
10:15	Katya Paliwoda	Holly Taylor		
10:30	Domenica Berardi	Thomas Kieran Redpath		
10:45	Stephanie Eilish McPherson-Brown	Lewis Milne		
11:00	Break			
11:15	Douglas Hutchison	Daniel Johnston		
11:30	Rachel Shannon	Susan Brush		
11:45	Anastasia Konstadopoulou	Jai Geelal		
12:00				
12:15	Break			
12:30	Keynote TL330 - Dr Rabia Khan			
12:45				
13:00				Lunch
13:15				
13:30				
13:45	Seating			
14:00	Meemi Matero	Syed Junaid Iqbal- M		
14:15	Marisa Sargent	Zainab Bosakhar - Z		
14:30	Lesley-Anne Rollins	Arthur Charney - Z		
14:45				
15:00	Break			
15:15	Valerie Martin	Gauri Goenka - M		
15:30	Laura Manderson	Lauren Gilmour		
15:45	Conor Hill - Z	Steven McLaughlin - M		
16:00	Valerie Ingram	Musa Ibrahim Bello		
16:15	Break			
16:30	Chairs Wrap Up			
16:45				
17:45	Drinks Reception (Level 6)			
18:45				
19:00- Onwards	Social at the Student Union			

Zoom Links

This year DSMS is taking the form of a hybrid event. All presentations will be streamed live from the three individual rooms. The link to each room will remain the same for the three days.

The links to each room can be found below:

DSMS 2022 - Room TL330

https://strath.zoom.us/j/84881248542

Password: 017438

DSMS 2022 - Room TL225

https://strath.zoom.us/j/83733162776

Password: 985386

DSMS 2022 - Room TL228

https://strath.zoom.us/j/88039008232

Password: 690551

Cambrex Gold Sponsor

Join us on Thursday 9th June at 14:00pm for a workshop with our gold sponsor Cambrex in TL330:

From our facility in Edinburgh, we provide world class solid form screening programmes including studies such as salt screening, polymorph screening, co-crystal screening, crystallization screening and further specialised screening activities. In addition, we have an industry leading crystallization process development team with extensive experience in the scale-up of crystallization processes from lab to plant, providing robust crystallizations for further manufacturing.

Crystallization process development at Edinburgh:

- Automated reactor systems
- 50 mL – 5 L controlled reactors
- Advanced process analytical tools (PAT)
- Design of Experiment (DoE) studies for process robustness and optimization

The work of these groups is supported by a full standalone analytical development capability with over 75 years combined analytical expertise.

An expansion of our facility was completed in 2020 and reflects the continued growth in our reputation and success in supporting our clients solid state and standalone analytical activities.

With more than 50 employees, Cambrex Edinburgh offers a range of career opportunities, with roles including, Chemical Engineers, Synthetic and Applied chemists, Analytical Development Chemists, Operations Leadership and Quality Assurance.

Facility details

- 15,000 square feet
- Extensive solid form screening
- Crystallization process development
- Peptide crystallization
- High potency capabilities
- Analytical method development (UHPLC, Dissolution, cleaning validation *etc.*)
- GMP release
- ICH validation
- ICH stability testing

List of Abstracts

Abstracts

Social Networking Sites usage by researchers': An application of UTAUT (The Unified Theory of Acceptance and Use of Technology)

Aaisha Rashid Al Badi, Diane Rasmussen Pennington

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Keywords: SNS (social networking sites), researcher, UTAUT, behaviour use, behaviour intention

The purpose of this study was to investigate the use of SNS by researchers and their behaviour when they conduct their research-related activities by using a mixed-methods approach and based on the Unified Theory of Acceptance and Use of Technology (UTAUT) to provide a theoretical framework. (Venkatesh, Morris et al. 2003) developed the Unified Theory of Acceptance and Use of Technology (UTAUT). This framework was developed to explain the user's intention to use and adopt a particular information system. It was constructed from four main factors that determine the intention and usage of information technology: performance expectancy, effort expectancy, facilitating conditions, and social influence. The theory has been applied in limited studies of researchers' use of social networking, namely (Gruzd, Staves et al. 2012).

This study employed a mixed-methods approach. In the initial phase, semi-structured interviews were used. The second phase was an online survey. UTAUT informed the questions that the authors asked participants in each phase. According to the analysis of the semi-structured interviews, the majority of researchers used SNS for their research-related activities. The data was collected from eight researchers from the University of Strathclyde. Also, there were some concerns from researchers about using Social Networking Sites for their research, such as fearing a lack of online security, feeling overwhelmed, and becoming distracted.

The findings from the survey also revealed a positive relationship between the four constructs of the UTAUT framework (Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Condition) associated with their intention to use SNS. The sample in this study was 216 participants from 40 universities in the United Kingdom. The majority were from the University of Strathclyde. 70% of respondents were using SNS for their research-related activities, while 30% were not using SNS for their research-related activities The findings indicate that the respondents used SNS for different purposes and used several types of SNS for their research-related activities. Moreover, several barriers kept respondents from using SNS for their research-related activities. For the moderating factors (age, gender, and experience), the Kruskal-Wallis test showed that there was

a statistically significant difference in the three moderators in users' behavioural intentions to use SNS for their research-related activities. Some items of UTAUT constructs had statistically significant differences, while other items had no effect. Thus, according to this study, the findings support the research hypothesis, demonstrating that study constructs have a significant impact on behavioural intention.

Most of the participants were from the University of Strathclyde, so we cannot generalise the findings to other universities. This research will continue to expand UTAUT to better reflect the exploration of social networking use within research practices. The results will increase researchers' awareness of how social networking sites can be used in improving research collaboration. The findings will offer an extensive understanding of the value of social networking sites, which will aid researchers to increase their visibility, and research activities online.

SNS appears to have a positive impact on researcher, so based on the findings of this research it is recommended that each academic department consider researchers' information needs and should work to make SNS services more useful and easier to use to meet the information needs of current and prospective users. Also, further improvements in institution infrastructure will allow researchers to obtain the greatest benefits from SNS. This research contributes to the limited previous research regarding the application of UTAUT to researchers' use of social networking sites.

References:

Gruzd, A., et al. (2012). "Connected scholars: Examining the role of social media in research practices of faculty using the UTAUT model." Computers in Human Behavior 28(6): 2340-2350.

Venkatesh, V., et al. (2003). "User acceptance of information technology: Toward a unified view." MIS quarterly: 425-478.

Gender Differences: Can Social Media and Distance Learning Enhance the Learning Experience during COVID-19.

Abdoalhamed Zngeena

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Key words: Social media, social networks, gender, higher education, distance learning

COVID-19 had a profound influence on the conduct of teaching and learning in higher education. As a result of the COVID-19 pandemic in 2020, distance learning became the only possible way to provide education. This led to a huge shift towards the use of social media by both genders. Manca and Ranieri (2017) and Al-Daihani et al. (2018) have demonstrated the ability of social media to transform scholarly communication. I believe that social media tools are becoming increasingly popular in research and scholarly communication because scholars are interacting on social media platforms, such as, Facebook, LinkedIn, and Twitter, as well as on specialized websites such as ResearchGate, Academia.edu, and Mendeley among others.

Having explored the subject area in detail, I can say that there are multiple gender differences pertaining to the use of social media among university students. Education process can be synchronized or unsynchronized depending on the blend of the internet technology used and the educational program used. I would say that there is a profound impact of a person's gender and personality on the use of social networking websites. Females are more likely than males to use social media for educational purposes (Alnjadat et al., 2019).

In conclusion, use of social media usage for distance learning has been so popular among both genders. In my research, we looked into the way social media and distance learning can enhance the learning experience during COVID-19. We used quantitative approach for the study and analyzed data using content analysis technique. Huge amounts of data were collected through survey questionnaires, which were sent to current students of the university. We found that although distance learning and social media enhances learning potential for students, but factors like students' age, personal relationships, and knowledge sharing aptitude lead to differences in the usage of social media websites between both genders.

References:

Al-Daihani, S.M., Al-Qallaf, J.S. and AlSaheeb, S.A., 2018. Use of social media by social science academics for scholarly communication. Global Knowledge, Memory and Communication.

Alnjadat, R., Hmaidi, M.M., Samha, T.E., Kilani, M.M. and Hasswan, A.M., 2019. Gender variations in social media usage and academic performance among the students of University of Sharjah. Journal of Taibah University medical sciences, 14(4), pp.390-394. Distance learning.

Manca, S. and Ranieri, M. (2017), "Exploring digital scholarship. a study on use of social media for scholarly communication among Italian academics", in Esposito, A.

(Ed.), Research 2.0 and the Impact of Digital Technologies on Scholarly Inquiry, IGI Global, Hershey, PA, pp. 116-141.

Predict the Availability of Electric Vehicle Charging Stations

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Key words: Electric Vehicle, Prediction, Time-series, Occupancy Rate, Deep Learning Algorithms,

Electric vehicles (EVs) have been broadly encouraged as a recognised factor in reducing global CO2 emissions and climate change. There is a noticeable spread of reliance on electric cars and the encouragement of their demand by governments in many countries. EVs are considered a feasible track in the direction of plummeting CO2 emissions from vehicles. To make low-emission energy alternatives reasonably accepted, charging and preservation infrastructure must be widely obtainable to allow users to comfortably and quickly recharge their EVs. Although the availability of EV charging stations is improving, the high cost limits the spread of fast-charging stations. As many EVs are driving on the road, it becomes a struggle to reach a charging point before running out of battery.

Innovative technologies can offer sensible and realistic solutions by analysing the available data on the neighbouring environment, producing a forecast system capable of learning from historical data, and predicting future forecasts that can improve charging point management—predicting charging stations' occupancy assists both EV drivers as well as station managers. In this research, we aim to investigate the capability to use deep learning approaches to predict the public charging station availability in cities. Memory-based RNNs processes have been revealed to provide superior, reliable results than Conventional Regression-based approaches such as Autoregressive Integrated Moving Average (ARIMA) method [1]. Some algorithms and strategies will be used to provide future forecasting of charging stations.

Time series analysis can be dealt with in frequency or time domain. In the frequency domain, the study of the data occurs in reference to frequency, whereas the time is the reference in the time domain [2]. Then, the final form of the data was used to train the models. The resulted in forecasts during the training stage were tested to evaluate the model performance. We believe that by providing accurate forecasting about charging stations, we increase the confidence of motorists in securing charging places for their EVs. On the other hand, the future forecasting about charging stations assist charging service providers in improving organising the limited available charging resources.

References:

[1] Siami-Namini, S., Tavakoli, N. and Namin, A.S. 2019. The Performance of LSTM and BiLSTM in Forecasting Time Series. In: 2019 IEEE International Conference on Big Data (Big Data)., pp. 3285–3292. doi: 10.1109/BigData47090.2019.9005997.

[2] Pickup, M 2020. Time Series Analysis. In: SAGE Research Methods Foundations. 1 Oliver’s Yard, 55 City Road, London EC1Y 1SP United Kingdom: SAGE Publications

Ltd. Available at: https://methods.sagepub.com/foundations/time-series-analysis [Accessed: 17 March 2022].

Next Generation Medical Design Tools: Comparison of current stent designs

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Key words: Aneurysm, Stent-grafts, Abaqus

An Abdominal Aortic Aneurysm (AAA) is the expansion of the aorta past its normal diameter to where it risks of rupture. To prevent this, a stent-graft is inserted into the area which is a tube of fabric held open by wire. The blood passes through this tube and thus prevents any pressure on the weakened, ballooned area of the aorta, and allows the artery to return to its normal diameter. These stents are inserted into the aorta via key-hole surgery, which is considered to be less invasive than open surgery. The key-hole surgery method involves compacting the stents down into a small tube and then feeding this tube up the patient's leg arteries. The tube is then retracted which deploys the stent into the aneurysm.

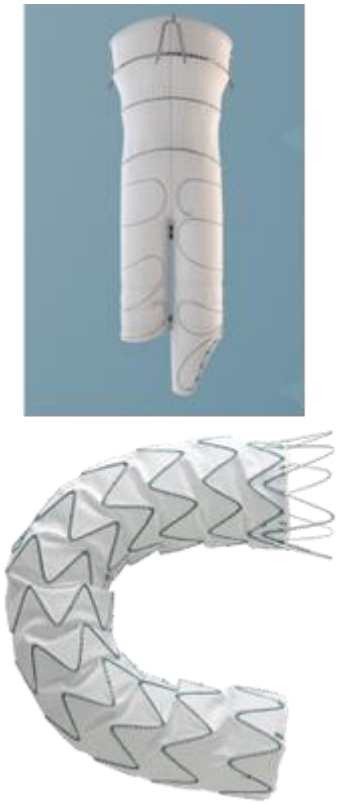

Figure 1: Image of a ring-stent (top) [1] and z-stent (bottom) [2].

This study focuses on improving the design of these stent-grafts and progressing the understanding of stents. This research focuses on two of the main stent designs, the ring-stent and the z-stent. Currently, there is little understanding of when either design of stent is preferable to the other. This study conducted an initial comparison between the two stents to guide future work. These results can then be

used to inform surgeons as to which stent design is best for a patient. To do this, computer simulations were created.

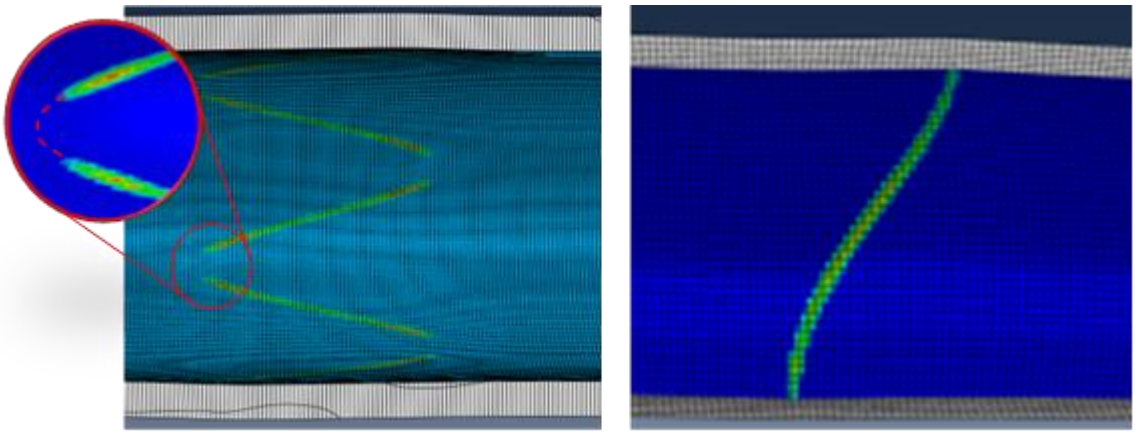

Figure 2: Sealing distribution of z-stent)left) and ring stent (right) on artery model. Included for the z-stent is a zoomed-in section of the apex which is not in contact with the artery wall and a dotted red line to show where the apex was expected to sit.

The primary variables that of interest when comparing the two stents are the sealing and the strains. The sealing of the stents is critical to look at as this demonstrates that the stent creates a full seal around the circumference of the artery and prevents the blood from flowing outside of the stent and potentially worsening the aneurysm. The sealing of the stents also indicates points of high force on the aorta walls which can lead to damage to the artery. The strains within the wires of the stent is important to investigate as this is what informs the fatigue-life of the stents. Typically, stress is used to inform fatigue-life but for the superelastic material used in stents, strain is used. The fatigue-life of a stent is how long a stent will last within a patient before failing and is dictated by an international standard that requires a stent to last a minimum of 10 years.

Figure 2 shows how each of the stents seals in the artery. Here it can be seen that the ring-stent is in full contact with the artery whereas the z-stent has gaps at the apexes. The specific rings used in this analysis for both the ring-stent and z-stent models are not the first rings in the stent. This might explain why the z-stent doesn't fully seal here, as it is not seen as crucial that the stent seal perfectly along the length, so long as the first ring fully seals.

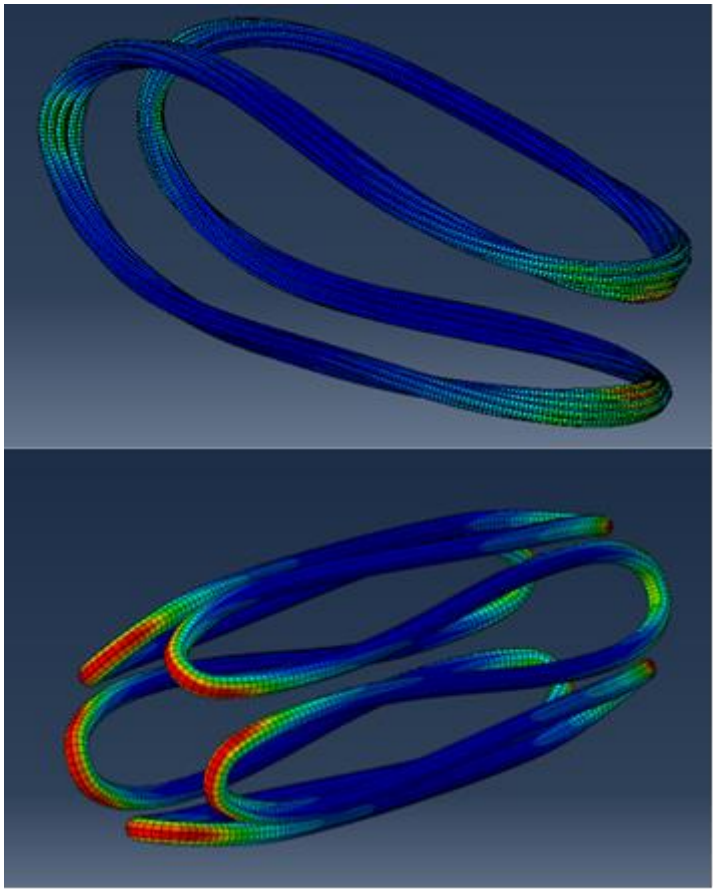

Figure 3: Strains on ring-stent (top) and z-stent (bottom) during compaction.

In terms of strain, Figure 3 shows the location of maximum (red) and minimum (blue) strains of each stent and the distribution of the stain across apexes. It can be easily seen that the strains between the two stents are very similar, both in terms of location and maximum values. The apexes of both stents are the areas of highest strain as the stents are compacted down ready for the key-hole surgery process.

These initial results, whilst useful for creating an initial understanding of the two rings, are not enough to provide a clear comparison between the two stent designs. It is hoped that future analysis and comparisons can provide a clear parameter that can be used for comparing the two designs of stents. This can then be used by surgeons to select the best stent design for the patient.

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Value Retention Processes and Their Role in Reducing the United Kingdom's Carbon Emissions

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Key words: Remanufacture, Comprehensive Refurbishment, Reuse, Climate Change, Carbon Dioxide

As a species, we emit 51 billion tons of carbon dioxide (CO2) into Earth's atmosphere every year (Gates, 2021), which is contributing to anthropogenic climate change and warming the planet. In response, commitments to reach carbon net-zero have been put in place over the last few years by governments globally, with timescales to achieve this varying between 2045 and 2060. The UK's aim is to reach net-zero by 2050, however, this only considers 54% of the UK's global contribution to carbon emissions. The remaining 46% consist of consumption emissions, which are produced abroad but are associated with materials and products that are imported and used within the UK (WWF, 2020). Expanding the use of value retention processes as laid out by the UN International Resource Panel (2018), offers an opportunity for the UK to retain embedded carbon in materials and extend product lifecycles, whilst also reducing associated cost.

The aim of this research is to investigate how increasing our remanufacturing, refurbishing and reuse capabilities in the UK would affect carbon emissions. By onshoring some remanufacturing capabilities, our territorial emissions would undoubtedly grow, however it would reduce our consumption and transportation emissions; but would this lead to a net reduction in global CO2 emissions? Having a more comprehensive understanding of the UK's contribution to climate change, increases the ability and likelihood of being able to significantly reduce it.

The study will be broken in to two case studies; the first, will assess the remanufacturing of the Yaw drives and gears of a wind turbine, while the second will look at the reuse of spent electric vehicle (EV) battery cells. Life cycle assessment (LCA) will be carried out to establish the emissions from manufacturing new, when compared to the emissions associated with remanufacturing an existing component. This will be assessed for the through-lifecycle of a wind turbine and an EV battery.

A reluctance to the use of refurbished parts has been acknowledged within the wind energy sector. There are concerns surrounding reliability and frequency of failure. Although, it is also widely acknowledged that there is no evidence (academic or otherwise) to support this hesitation and in fact it is more a perceived problem, than an experienced one. The wind energy industry has been heavily subsidised and in order to reach output targets, newly manufactured parts have often been prioritised. However, with delays caused to component imports by Brexit and this contributing to longer lead-times, momentum is growing to incorporate more refurbished components within assets.

Implications of this research include encouraging more responsible design, by considering multiple lifecycles of a product, enabling upgrades and the refurbishment of components. It also has the capability to highlight how expanding the UK's remanufacturing, refurbishing and reuse capabilities, can lead to benefits for local, regional and global populations, on both societal and environmental levels.

As described by Elhacham et al in 2020, the weight of all artificial, man-made produce is now equal to the weight of all living biomass on Planet Earth. It is imperative for our species survival that we respond to the evidence of climate change and rapidly reduce our carbon emissions. It will be necessary to embrace wide use of value retention processes in industries that will be vital if we are to reach and maintain net-zero carbon emissions throughout the UK and rest of the world.

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Decarbonising Pathways for Whisky Industry

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Key words: Process Heating, Biogas, Hydrogen, Electrification, Carbon emissions

It is the demand of changing world to cut down fossil fuel dependency and shift to the renewable sources in every sector of life. The Scotch Whisky Association has also pledged to decrease the carbon emissions to 40% by 2030. Whisky industry accounts for approximately 1% of Scottish emissions and 40% of the emissions from distillery site are from the process heating by fossil fuels. This study focuses on decarbonizing the process heating of whisky industry by three available renewable energy technologies i.e., biogas generation from whisky waste, green hydrogen, and electrification of the heating process.

A feasibility analysis tool for distilleries in the United Kingdom has been created to aid the distilleries in finding the best technology specifically for their plant by comparing the economic and environmental benefits over the span of 25 years. It provides an estimation of capital and operating costs associated with the renewable technology along with the reduction in carbon emissions it offers. Additionally, it calculates the carbon emissions throughout the life cycle of the whisky production and will help distilleries in reporting their carbon emissions. The methodology involved literature review, data gathering from industries, site visits, and calculations using excel visual basic coding which were validated by Scottish whisky association feasibility studies and software named Aspen Plus.

Cost analysis results show that installing an anaerobic digestion plant to produce biogas from whisky waste is economically feasible for a distillery producing more than 15 million litres of whisky per annum. Only 3 out of 120 distilleries in Scotland operate at this capacity, however, distilleries located nearby such as Islay distilleries can install a single anaerobic digestion plant with a combine capacity exceeding the minimum requirement. Installation of anaerobic digestion with a combined heat and power plant can only be economically beneficial if the renewable energy tariff for selling electricity increases above 19 p/kWh. Smaller scale distilleries that cannot benefit from anaerobic digestion plant can opt to replace natural gas with hydrogen as the price of green hydrogen is predicted to decrease to that of natural gas by 2050. With the ongoing energy crisis, the tool is currently suggesting that hydrogen is a cheaper option to run than electrification, this could change if the cost of electricity comes down to 10 p/kWh. The tool is therefore designed for users to input

their own energy costs and inflation rates. Hence, the tool will offer the flexibility of evaluating the technologies anytime in the future.

Environmental feasibility analysis shows that the onsite production of biogas from whisky waste can reduce the heating emissions by 74% whereas the combination of anaerobic digestion and combined heat and power plant can offer up to 76% reduction in the carbon emissions produced by the process heating. Replacing natural gas with green hydrogen will provide the highest reduction in emissions i.e., 93%. Electrification, on the other hand, can only reduce the emissions by 12% due to heavy dependency of the electricity grid on fossil fuels, however, according to the steady progression predictions by the national grid, the emissions can be reduced up to 75% by 2050.

The Impact of the New Higher Education Policies on Kuwait University: A Faculty Perspective

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Keywords: Higher education, Educational policy, Kuwait, Faculty, Implementation

New Kuwait Vision 2035, a new vision statement adopted in 2010, contains numerous recommendations for developments in the economic and higher education sectors of Kuwait, including the opening of a new Kuwait University main campus in the academic city of Sabah Alsalim, with more facilities for academic and social societies. The purpose of this study is to explore the impact of New Kuwait Vision 2035 higher education policies on university development in Kuwait based on the perspectives of the faculty members. The main research questions directing the study are as follows: What does New Kuwait Vision 2035 say about policies for higher education? How have the policies impacted on curriculum reform and pedagogy? How have the policies impacted on programme variety? In terms of its objectives, the study seeks to identify the New Kuwait Vision 2035's standards for higher education policies in relation to curriculum reform and pedagogy, investigate the knowledge of New Kuwait Vision 2035 and its policies for higher education in the country, examine the impact of New Kuwait Vision 2035's standards for current university development in Kuwait in relation to the university curriculum reform, and explore the developments and improvements in curriculum reform and pedagogy. The objectives of this research will determine its methodology. I will rely on qualitative approaches. The data collection sites include Kuwait University, which has been chosen because it is the main higher education governmental institution in Kuwait.

How do New Ventures Adapt an Emerging Technology: The Case of Blockchain in the Music Industry

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Key words: Blockchain; Digital Business Models; Adaptation Activities; Platform Entrepreneurship

How do emerging ventures adapt a foundational technology: The case of Blockchain in the music industry. First to define the terminology, a foundational technology refers to any groundbreaking technology with a systemic impact, Blockchain is a distributed decentralized peer-to-peer sharing database. Emerging foundational technologies provide an interesting area to study for a variety of reasons (Santos and Eisenhardt, 2009), due to numerous characteristics such as incompleteness, evolvability and interoperability. As an enabler of entrepreneurial activity in the music industry, Blockchain provides a wide range of product and service and business model applications that can be produced by emerging ventures. Blockchain is enabling a new type of platform business model, challenging the existing business models of firms (Trabucchi et al., 2020). And is growing continuously in the modern economy in the scope of academia, industry, venture capital and government attention. The music industry is always one of the first to confront technological change, and a new wave of new ventures combining Blockchain to solve some of the industry's most widely spread problems is prevalent. This research uncovers the way that emerging ventures adapt this powerful foundational technology.

The key areas this research is placed within is External Enablers (Davidsson, Recker and von Briel, 2017), Digital Business Model Design (Zott and Amit, 2017), and Platform Entrepreneurship (Van Alstyne, Parker & Choudary, 2016). There is a multi-method approach for this study (1) Company Whitepaper analysis, and (2) in-depth, longitudinal interviews with 12 of the ventures in the sample. The findings of the research have revealed the phases of development that the ventures experience in adapting Blockchain; from the initial concept of the imagined future (Davidsson, 2020), to the adaptation activities that ventures must engage in to successfully navigate this technology. It is worth noting, that at the time of initial data collection, the combination of Blockchain with the music industry was still in its early stages of development and there had not been a real success story that had emerged from the start-up landscape. Given that the application of Blockchain technology was, and largely still is, at an extremely emergent, nascent stage, the findings of this study emphasise the actions and contributions of early adopters, whose aspirations were rooted in visions of what could possibly be imagined and built, using Blockchain.

Several key tensions have emerged in this study, namely, the balance of openness and closeness within the start-up industry; Field level vs. Firm level actions; Passive and Direct Action sets; Ideology vs. Profit, and Legitimacy Work. This

research contributes to Digital Platform Literature; Digital Business Models; Business Model Innovation in Digital Settings; and Dominant Design.

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Education Integrity. Case Study: Greek Education

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Key words: Corruption, Integrity Violations, Education, Greece, Rule of law.

Corruption (grand or petty) is a multidimensional social phenomenon that penetrates and transgresses many facets of societies. According to Transparency International it is about "the abuse of entrusted power for private gain". Corruption erodes trust, weakens democracy, hampers economic development, and further exacerbates inequality, poverty, and social division. In the domain of education, it is a real plague as it threatens, among others, ethics, morals, equal access, education quality and credibility. It also undermines Higher Education, its values, and its status. It signifies a menace for education integrity and renders it vulnerable and tolerable to integrity violations, too. Without having a close focus on integrity, a fight against corruption in education would be like fighting the symptoms of a disease without pinpointing its cause. All the aforementioned set the rationale of this research.

Hence, the aim of this work is to explore the reasonings, the incentives, the chances and agents engaged in corrupt contexts in education. Greece, the cradle of democracy, is the case study, since it is considered the most corrupt country after Bulgaria in Europe (CPI, 2019). Unsustainable rule of law, economic crisis followed by dramatic cuts in public spending, and its highly centralised and politicised system exert strong influences on its education at all levels. Especially in the tertiary education, under the coverage of academic freedom, integrity violations take place on a regular basis, and there is a vicious and corrupt barter between politicised teachers and students for personal gains.

In the light of all these, the methodology of this research includes theoretical and empirical literature pertaining to the variables of rule of law and culture and their correlation to education integrity. Milovanovitch qualitative method and a purposeful sampling approach are also applied to conduct this research and collect robust data.

The implications of this research are profound since this academic statistical evidence can provide policy makers, political actors and education stakeholders with useful insights to form effective policies to strengthen education integrity and anticorruption efforts not only in Greece but in other countries like Greece, too. Under a social point of view, taking into consideration the fact that corruption thrives in silence, this study may set a strong signal against potential negative social consequences when "entire generations of youth are mis-educated to believe that personal success comes not through merit and hard work, but through favouritism, bribery, and fraud[1]. On a personal basis, this study gives the author the chance to challenge education corruption and shield and heighten education integrity and contribute to 2030 Agenda anticorruption efforts. If it sounds utopian then let's remember Margaret Mead's words: 'even a small group of thoughtful, committed citizens can change the world, indeed".

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Gigacycle fatigue performance of welded steel joints

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Key words: Gigacycle fatigue, Welded joint, Structural steel, Ultrasonic fatigue testing, Metallography

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. 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 lighter machines with greater structural integrity. Lighter and more durable structures have the potential to reduce the energy used for mineral processing, reducing the carbon footprint of the industry.

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 conventional machines.

The first part of this research involved experimentally investigating the optimal welding parameters using the flux-core arc welding method for the in-house fabrication of S275 structural steel butt joints. This steel grade and welding method were selected as they are commonly used in the mining sector. In tandem with this, a finite element model was developed to simulate this welding process. A metallurgical study was also conducted, investigating the microstructure of the weld and surrounding base metal,

to determine the weld quality and validate the model. This preliminary work will enable the production of ultrasonic fatigue samples and the generation of novel fatigue data for this specific steel and welding process.

Streamlining Collection Management Policy Development Framework: A Case Study Of A Glaswegian Victorian Era Collection

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Key words: special collections, collection management policy, public libraries, policy creation, collection management

A major problem facing special collections libraries across the world is the lack of comprehensive collection management policies (CMPs), especially regarding collections that may have valuable items, either monetarily or emotionally. My doctoral research continues from my master's dissertation, concerning itself with attempting to create a thorough CMP regarding the Stirling Maxwell donation held at the Mitchell Library. This collection consists of literature spanning from the 16th century to the 20th century and was built during the early Victorian era by Sir William Stirling Maxwell. It was donated in multiple parts by Stirling Maxwell's son, and the current cataloguing situation—a slip index/catalogue—needs to be digitised and the collection analysed to see whether the collection should be reconsolidated as a collection in its own right or kept in its current separated storage situation.

I previously analysed three areas of Victorian society that appear as themes in the Stirling Maxwell collection, with the intent to provide a contemporary context for the items held within. I also conducted a brief review of what could be considered best practices in three fields of CMP creation (special collections, public libraries, and museums—picked for their relation to where the Stirling Maxwell collection sits), with the intent to use these best practices to create a policy for the Stirling Maxwell collection that the librarians at the Mitchell could use and/or adapt for other collections under their purview. I then continued with an analysis of Sir William Stirling Maxwell himself, attempting to provide a complete, thorough understanding of the collection's builder that provided the specific recommendation that the collection be reconsolidated as its own collection. At that time, it became clear that the creation of a CMP was outside the scope of a master's dissertation due to uncovering multiple factors that must be considered when creating a CMP in any library. These factors required the level of intensive research given in the creation of a PhD dissertation. I was able to decide that *all* fields of collection management are incredibly vocal about the need for the job of policy creation to be that of a team rather than a single person.

The end goals for my doctoral research are not only to complete the digitised finding aid and a CMP specifically for the Stirling Maxwell collection, but also to create a more streamlined approach for libraries across the UK as well as outwith the country to take when attempting to create their own collection management policies. As mentioned previously, CMPs are vital for libraries, but difficult to create if one does not already exist. Important factors that librarians must consider include current condition/upkeep of the physical items, available physical storage space, costs of both storage/upkeep as well as any staffing changes that take place during or after the

creation of the policy. This last factor is especially important when considering collections held by public libraries that are traditionally underfunded and struggle with understaffing, which in turn affects their ability to spare time/staff to create the vital CMPs that will ease any of this strain in the long term.

Additional layers of difficulty arise when it comes to collections or libraries that may span multiple fields of librarianship, as there is very little literature about interdisciplinary collection management. This immense gap in the literature makes CMP creation even *more* difficult and time-consuming for libraries already struggling with staffing or funding issues

By finding ways to streamline this process for libraries such as the Mitchell, I aim to make the use of such policies more widespread because the creation process will take up less financial and personnel space from other important librarian job functions. This change in the way CMPs are created will even lead to improvements in services that will trickle down to the everyday users by creating clear, well-structured, and organised collections that the users can trust to support the library's objectives and purposes.

Delivering Cultural Heritage Tourism in Developing Countries

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Key words: Heritage Tourism, Cultural Heritage Tourism, Cultural Heritage Resources, Stakeholders, Developing Country

Cultural heritage tourism, a sub-category of heritage tourism can be referred to as traveling to places and activities that genuinely depict the stories and people of the past and present (Chourasia and Chourasia, 2012; National Trust for Historic Preservation, 2014). Most countries across the world thus promote cultural preservation as a valued community resource. Stakeholders are a significant component of the structure of the region in which cultural heritage resources work, because when stakeholders responsibly use cultural heritage resources to meet their needs, they have a substantial impact on their preservation and growth, and these resources have a significant impact on the stakeholders' personal development and relationships with the environment (Góral, 2015).

Many studies have been conducted around the world to link the concept of sustainability to stakeholder perspectives of cultural heritage tourism resources. This research is influenced by scholars (Garrod and Fyall, 2000; Leask, 2008, 2010; Poria et al., 2003; Timothy, 2018) who drew attention to the limited analysis of cultural heritage tourism in a diverse setting, especially from the supplier perspectives, although they are mostly from a developed country viewpoint. Even while only a few studies focused on the roles of stakeholders in the development of cultural heritage tourism in developing countries, they ignored to include the supply side of the resources (Sinha and Pratt, 2021; KC, Dhungana and Dangi, 2021). Furthermore, cultural heritage tourism is a growing sector with the potential to benefit all sorts of markets (Richards, 2006); as a result, cultural heritage tourism in developing countries is worth investigating.

The study thus takes place in Bangladesh, a developing country offering tremendous potential for cultural heritage tourism but trailing behind in drawing international tourists to its cultural heritage resources. The Historic Mosque town of Bagerhat, one of the UNESCO designated world heritage sites in Bangladesh has been chosen for the study. The research design will be qualitative, including semi-structured in-depth interviews with the site managers and employees who have relevant knowledge and expertise in delivering cultural heritage tourism at the designated heritage site. Due to the greater depth of the method for analysing the issue, in-depth interviews will be conducted (Crabtree et al, 1993).

By investigating how cultural heritage tourism is delivered in cultural heritage sites in a developing country, this study will add to the expanding body of literature in cultural heritage tourism. The findings could pave the way for more research and serve as a model for other developing countries, like Bangladesh. Furthermore, it may contribute to SDG 12 - Responsible Consumption and Production by allowing cultural heritage suppliers to engage in more responsible resource production and delivery by implementing sustainable practices that could meet both current consumer and business needs while also preserving or improving future generations' ability to meet those needs.

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Comparative Analysis: DDoS Attacks In Blockchain and Traditional Systems

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Key words: DDoS, Blockchain, Centralized, Decentralized, CTI

Distributed Denial of Service (DDoS) has been in existence for more than two decades and since then several mitigation schemes have been designed and developed (Wani et al., 2021). The attack represents a severe risk to the cyber world. It is a foremost concern for system administrators and security experts. These attacks can instantly harm a target, causing enormous revenue losses (Bawany et al., 2017). The attack can be performed in both centralized and de centralized systems. DDoS attack is organized by an attacker using malicious codes installed on various computers for attacking a specific target (Uddin, 2013). This paper will look at DDoS attacks in both centralized and decentralized systems. It will analyse the attacking methods and the preventive measures taken by both systems. The method to be used in achieving this objective is Cyber Threat Intelligence (CTI). CTI is a real-time threat analysis, visualization and incidence response tool. The tool depends on three decision making paradigm, Strategic, Tactical and Operational. Cyber Threat intelligence is the process of gathering evidence-based knowledge, involving context, mechanisms, signs, implications and actionable information about a cyber threat (Mavroeidis & Bromander, 2017). The study will offer a better insight of the current methods and preventive of DDoS attack mechanism in blockchain and traditional systems. It will likewise contribute by exploring the inter-correlation of DDoS in both the centralized and decentralized networks by employing association rule mining techniques, to develop threat association rules. Finally, the paper can be useful for researchers, system administrators and security experts.

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Lend Us an Ear: Investigating the Tuning Role of an Insect's Sound Chambers

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Key words: Bio-inspiration, insect ears, micro-scale sound sensors

Bio-inspiration, or biomimicry, is the study of natural mechanisms with the aim of thereby inspiring novel engineering solutions. Micro-scale sound sensors are ubiquitous within today's technologies. Receiving and processing sound at this minute scale is more challenging because the wavelength of the signal can be many times the size of the device. Therefore, sensors such as the microphones inside smartphones and hearing aids are encountering engineering bottlenecks. Insect ears represent a diverse resource library of micro-scale sensors the mechanisms of which 'already' overcome the same shared micro-scale problems. Understanding how these mechanisms work may therefore provide engineers with insights into how to develop improved micro-scale acoustic products.

Field cricket ears are one of the most complex among all invertebrates and are known to be unusually sharply tuned to a low frequency representing a wavelength considerably larger than the insect's ear. How the animal achieves this mechanically is not known. The ear anatomy includes two sound chambers, one large one small, connected by two small holes. These chambers separate the sound inputs of the ear from the neuronal sensors responsible for converting the sound information into an electrical signal. This research hypothesises that the unique geometry of the chambers influences the movement of the incoming sound in such a way as to sharply tune the neurons, functioning similarly to a musical instrument like a flute.

To test this hypothesis, the cricket's ear has been imaged using a micro-CT scanner, the chambers isolated digitally, and the first-ever measurements extracted. Incorporating these measurements into computer simulations under varying sound conditions, should reveal how the sound is moving through these chambers; again, for the first time. Preliminary data suggests sound speed through these geometries is indeed sharply tuned at the relevant frequency and in the part of the ear where the neuronal sensors are located.

Conceivably, a new micro-scale tuning mechanism has been discovered. If so, we propose that this discovery would be most relevant to the up-and-coming engineering field of 'acoustic metamaterials' - specially designed shapes that can isolate targeted frequencies and be used for noise cancellation purposes, such as improving a room's acoustics via wall cladding. It is well known that making these shapes small enough whilst also being able to target sounds with large wavelengths is a challenge. A micro-scale mechanism that uses geometry (shape) to sharply tune to a low sound frequency would be highly relevant to helping to alleviate this problem.

The Rights of Women in Transitional Justice

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Key words: Transitional Justice, Participation, Women's Rights, Legal Geography, Truth Commission

The United Nations defines transitional justice as “the full range of processes and mechanisms associated with a society’s attempts to come to terms with a legacy of large-scale past abuses, in order to ensure accountability, serve justice and achieve reconciliation”. [1] United Nations Security Council Resolution 1325 requires that states “ensure increased representation of women at all decision-making levels in national, regional and international institutions and mechanisms for the prevention, management, and resolution of conflict,” including transitional justice processes and mechanisms. However, 20 years since the Resolution was passed, scholars continue to argue that conflict prevention, management and resolution processes are gendered - biased to men’s advantage – and that this results in women’s continued exclusion from these processes. [2]

Transitional justice literature frequently addresses the problems that occur in transitional justice processes. However, while much scholarship is dedicated to documenting and trying to solve these problems, less attention has been paid to how and why these problems continue to arise. While many traditional analyses of transitional justice focus on the application of international law to redress historical wrongs, transitional justice processes actually represent the interaction of many complex legal, territorial, political, and social dynamics. They are characterised by the interaction of multiple, intersecting international and domestic laws, legal systems, cultures and customs which compete for primacy, with these dynamics evolving constantly throughout the process. This can be observed in the case of Liberia, with the Liberian Truth and Reconciliation Commission (TRC) aiming to achieve national reconciliation among multiple warring ethnic groups, in many languages, by applying principles of both national and international law, all while respecting customary and religious justice practices.

This project argues that it is the very interaction of all of these dynamics which shapes the transitional justice process itself, with these dynamics thus creating barriers or opportunities for women’s participation. The paper proposes a unique analysis of the Liberian TRC grounded in the legal geographical concepts of space, complexity and constitutively. The project involves analysis of the reports of the Liberian TRC, and of a range of secondary sources. It argues that, by understanding the legal complexity of this transitional justice space, we can understand how women were constituted by and within that space, perhaps revealing previously unseen factors which affected their participation in the TRC. By illuminating the relationships and dynamics at play between space, law, and women as subjects of transitional justice processes, the project hopes to uncover how contemporary transitional justice

models fail to facilitate women's' participation in these processes. An understanding of these failures is important, as it will perhaps allow these failures to be addressed or prevented in future, thus ensuring women's full participation in transitional justice processes.

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Solution of the Dynamics of the *FutureForge* Manipulator

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Keywords: Nonlinear dynamics, Industrial engineering, Differential equations, Perturbation methods, Linearisation

Traditionally speaking, the modern forge takes its origins from blacksmiths' workshops. However - because of the scale of materials being handled now, the extreme temperatures being used, and the forces at play - modern forges are dangerous environments for people to be working in. Additionally, while there is charm and artistry to hand-made items in this general process, the accuracy and precision demanded in modern industry is a strong argument for removing people from the equation as much as possible. With these factors in mind, Strathclyde's Advanced Forming Research Centre (AFRC) has been working on a project entitled The *FutureForge*. The *FutureForge* is intended to be a world-leading forging platform and consists of two major components: a 2,000-tonne hydraulic press; and a similarly massive robotic arm. These are very much analogous to the blacksmith's hammer and hand manipulating the material. This piece of research focuses on the robotic arm (or "manipulator") in this environment and on how we can safely control this next generation of industrial robot.

Figure 1: The *FutureForge* manipulator installed at the AFRC

Previous work derived the equations that describe the manipulator's motion, which produced two very large, unwieldy differential equations. Taking off from this previous work, our task is to solve this system of equations. The reason that we want to solve

this system of equations is two-fold. Firstly, having a reliable solution to the system enables us to accurately simulate the machine's behaviour. In turn, this allows us to make observations and predictions that can help guide safety practices and operational procedures. The second motivation we have is to design a suitable control system for the manipulator: ensuring its behaviour is true to what the operator has specified down to the sub-millimetric scale. While this present work focuses only on obtaining the solutions, it is important to note that these are our intentions as they guide decisions made along the way. The overview of our approach begins with the reduction of the governing equations into an accepted standard form – grouping large expressions of geometric terms into more manageable constants. After this, a significant step was to convert the trigonometric terms into algebraic expressions. We went about this step by making pragmatic observations about how/where we could afford to reduce the accuracy of our model: the result being an approximate set of equations that trades some degree of accuracy for solvability. In truth, this last statement is arguably the ultimate challenge that characterises the bridge between engineering dynamics and control design. Making further pragmatic observations (regarding how the manipulator would be operated), we were able to reduce the system's complexity by showing how the gravitational terms can be removed from consideration entirely. The result of these efforts is an algorithm that adequately approximates the manipulator's behaviour under the operating conditions described to us by our industrial partners.

Desire alone as an agent of change: When Pygmalion created Galatea, did he consider Leadership, Followership, both, or neither?

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Keywords: Leadership, Followership, Change Agent, Change Management, Achievement

Academic researchers in the field of Leadership have spent most of the last century attempting to prove that Leadership is not something that we are born with, but that it is something which can be taught. The result of this research is now more than 60 Theories of Leadership and well over one and a half thousand definitions (Mango, 2018) which are being added to daily. This is not helpful for any organisation interested in effective personal development.

The issue is further confused by research which supports the "born with" Leadership concept, Van Vugt (2006) having identified a genetic component in his exploration of Leadership and Followership as evolutionary constructs rather than the social construct implied by the absence of a single unifying theory and a universally accepted definition.

Nevertheless, research based on netnography (research in social media) suggests that Leadership development in the 21st century owes more to memes than genes, with one of the more prominent motivational tropes being "Leaders Create Leaders". A google search for this quote will generate around EIGHT BILLION results, but where in our organisations are we seeing the consistent, reliable, and repeatable results of its application? Where are we going wrong?

This paper will use the metaphor of Pygmalion to explore how Leaders attempt to create other Leaders and show how that could be made much more effective with an understanding of Followership. We will see that it is not sufficient simply to create an image of perfection, true Leadership requires us to fashion the skills, knowledge and understanding which are invisible at surface level but essential to perfect performance. Desire alone is insufficient; it must be backed with thoughtful development at a person-by-person level.

In that desire for a more capable structure, we routinely see organisational commitment to spending vast sums on Leadership training that is still not producing lasting change, the opportunity cost being training on Followership which will. Followership is no longer an unknown quantity, but it is clearly under-utilised and largely misunderstood as a Leader-centric set of instructions designed to manage subordinates more effectively. This can be seen as the intent to create the organisational equivalent of the wife of Pygmalion's dreams. She can be seen as perfect in appearance but neither allowed to shape the creator in turn, nor act independently in pursuit of a better, collaborative result which will benefit all and exceed what might otherwise have been achieved on a merely collective basis.

We also use this metaphor to explore the patriarchal nature of traditional Leadership thinking and how that approach is more likely to perpetuate the unequal "business as usual" nature of organisations rather than allow for a more sustainable, and desirable, outcome based on equality, diversity, and inclusion.

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Identity recognition in applied contexts: Selection as a route to enhance performance

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Key words: Voice recognition, Face recognition, Accuracy, Real world application, Super-face-recognisers

Objective: While familiar identity recognition is a highly accurate and effortless process, unfamiliar identity recognition (e.g. recognising new instances of a criminal suspect) is a challenging task and one that is prone to error. Despite this, it is unfamiliar identity verification, both from faces and voices that underpins key applied contexts in policing, the criminal justice system, and border control. Research has shown that error rates for unfamiliar face and voice tasks are non-trivial, around 20%-30% for both student samples and specialists, and that such rates are unaffected by training or experience. However, there is a large range of individual differences in unfamiliar face and voice recognition ability, with some individuals naturally excelling at identity recognition. The focus now is to find ways to test and detect such individuals and select them for the roles, outlined above, in which identity recognition is key. Here, we build on previous research to test two critical hypotheses. First, is it the case that established voice recognition tests (using vowel sounds) actually tap individual differences in real voice recognition (i.e. for spoken sentence of the kind likely to be encountered by practitioners)? Second, is it the case that individuals who tend to perform at the top end in terms of voice recognition performance also show the same ability for faces?

Methodology: Across three experiments, participants completed established tests of unfamiliar voice (vowel sounds) and face identification alongside our newly created Strathclyde voice identification tests (full sentences). Over 300 students, from the University of Strathclyde, took part in the study and they were given one course credit for their participation.

Results: The findings showed large positive correlations between each constrained voice identification task and its novel naturalistic counterpart. This shows that the established vowel-sound voice tests are robust measures of real world voice recognition ability. We also show small-to-medium correlations between voice and face identification performance. This finding suggests that organisations and agencies looking to select and recruit individuals for their identity recognition expertise are likely to encounter some people who excel at both face and voice recognition. This is particularly important for operations in which both face and voice evidence is available.

Conclusions: The findings from this study promote several important changes that could be made to real world organisational practice. First, we add to previous research which shows that, in lieu of effective training methods, policing, the security

and border services, should be looking to recruit individuals with natural identity recognition ability. Second, that we should be testing eye- and ear-witnesses and jury members on their identity recognition abilities for cases in which faces (e.g. CCTV) or voices (e.g. phone recording) have major evidential weight. Third, we confirm the robustness of established voice recognition tests for this purpose. Finally, our work can also be extended to the automatic face and voice recognition field, to ensure that benchmark accuracy rates are not reduced by poor operator recognition ability, we need to be pairing our best automated systems with our best human recognisers.

Determining the metabolic plasticity of senescent and breast cancer sub-phenotypes

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Key words: Metabolism, Senescence, Breast Cancer, Mass Spectrometry, Metabolic reprogramming

INTRODUCTION: Metabolomics is the study of low-molecular-weight metabolites present in biological samples which can be a powerful technology to evaluate drug actions, disease mechanisms, and identify potential biomarkers. At present, phenotypic sub-types (observable traits) of senescent and breast cancer cells lack comprehensive biomolecular classification (1,2). Senescence phenotypes have been profiled based on the typology of cellular damage and senescence induction method (3), while breast cancer cell lines have been classified based on their molecular features (4). These methodologies are not sufficient for elucidating the inter- and intra-heterogeneity of the multiple phenotypes of these cell types. Thus, more robust approaches need to be developed to characterise their different phenotypes and provide a better understanding of the disease mechanisms of the target clinical phenotype.

AIM: This study aimed to assess key metabolic pathways altered following ionization radiation and drug treatment in both senescent (HFF-1) and breast cancer cells (MCF7, MDA-MB-231, and HCC1937).

METHODS: Human fibroblasts were independently treated with ionizing radiation, hydroxyurea and etoposide to induce cellular senescence. A panel of breast cancer cells with different hormone receptor expression patterns were characterized for their phenotypic and metabolic response to Olaparib drug treatment at various doses and durations of treatment. Untargeted liquid chromatography-mass spectrometry metabolomics analyses in combination with molecular biology based phenotypic assays (Crystal violet, MTS assay, and immunofluorescence detection of markers for DNA damage/repair and cell cycle activity) were performed to determine relative patterns of biochemical pathways altered by drug treatment.

RESULTS: Senescent and breast cancer cells showed differential expression of molecular and metabolic features that identified the different sample groups (treated and non-treated cells). Subsequent network analysis has shed light on the major metabolic pathways - energy, amino acid, and lipid metabolism – that are altered upon ionizing radiation/drug treatment.

CONCLUSIONS: Untargeted metabolomics is a powerful tool for identifying metabolic differences occurring in response to drug treatment and biological stimuli. Our future work will focus on the targeted analysis of pathways identified from this work. This comprehensive analytical strategy represents a step forward toward

precision medicine, which aims to improve medical treatments of patients according to their individual features.

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The link between poverty and mathematics attainment in primary schools

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Key words: Mathematics, poverty, attainment, attitude, anxiety.

The purpose of the research is to characterise the link between relative deprivation and poorer attainment in mathematics in one Scottish local authority's primary schools then identify a protocol which may improve outcomes for relatively more deprived children. Mathematics attainment at age 7 and 11 is predictive of socioeconomic status in later life (Ritchie & Bates, 2013) while OECD analysis indicates that half a standard deviation improvement in mathematics attainment in a country is linked to a 1% increase in GDP (OECD, 2010). At a personal and societal level, success in mathematics makes a positive difference.

The first stage of the research is complete, involving analysis of secondary attainment data from the 2017 cohort of Primary 7 children in one Scottish local authority in order to determine whether there is a relationship between relative deprivation and lower attainment in mathematics. A hierarchical logistic regression was carried out with Free Meal Entitlement as the outcome variable and mental arithmetic, reading and developed ability scores entered as predictor variables in Block 1 and general mathematics scores added at Block 2. The addition of general mathematics at Bock 2 significantly improved the fit of the model (Chi-square for the change of fit = 21.992, 2df, $p<.001$). Free school meal status is a proxy measure for poverty and the results indicate there is in fact a connection between relative poverty, using free school meal status as a proxy, and attainment in mathematics.

A range of factors contribute to poorer outcomes for more deprived children including at community, family, school and child level (Banerjee, 2016). At an individual child level, self-concept as a learner as well as attitude and mathematics anxiety can influence outcomes and these are issues more associated with higher deprivation. A peer assisted learning intervention has been completed focusing on psychological variables. Children in two classes played maths games 3 times a week for 20 minutes over a six week period. Initial analysis suggests a very slight improvement in pre and post intervention results.

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The lived experiences of adolescents with albinism in Malawi

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Key words: Albinism, disability, adolescents, Malawi, participatory methods

Background: Albinism is a rare condition that causes to lack of skin pigment, however, it is largely misunderstood in African contexts thus leading to prejudice, stigma, exclusion and in extreme cases even violent attacks against people with albinism (PWA). The social attitudes in sub-Saharan Africa conveyed through harmful myths are what lead to challenges faced by PWA in their day-to-day contexts. The prevalence of albinism across the world is estimated at one in 20,000. The prevailing rate is considerably higher in sub-Saharan Africa, with Malawi having one of the highest populations of PWA on the continent. As many as 40% of Malawi's PWA population are adolescents. However, the number of studies on lived experiences of PWA is small, and the absence of the voices of adolescents with albinism is an even wider gap. In addition, we know very little about the unique experiences of adolescent girls with albinism. As Stalker (2012) has argued, this is problematic because the voices of children and young people in research are important. This study aims to address that gap.

Purpose of study: To contribute to closing a knowledge gap in order to inform policy-makers and high-level stakeholders (e.g. Ministry of Gender, Disability and Social Welfare) for developing evidence-based tools to support the full inclusion of young people with albinism through services.

Research Questions: What are the lived experiences of adolescents growing up with albinism as they navigate everyday life? More specifically: (1) What are the lived experiences of adolescent girls with albinism? (2) In what ways does stigma and vulnerability of albinism complicate access to health, education, relationships and social participation for adolescents with albinism? (3) What hinders or enables their access to health, education, relationships and social participation?

Methodology: Participatory methods within an ethnography will be adopted, focusing on adolescents with albinism recruited through NGOs where they are service users. In addition, interviews will also be done with service providers and, in order for this research to give power to a group that is typically excluded from participation, participatory methods with adolescents with albinism shall be conducted using drama, journaling, drawings and photograph collages. Participatory methods will allow access to young people's authentic narratives. Ethically, the study will ensure fully informed consent and assent as well as anonymity for participants.

Significance: Findings will give voice to a minority group in Africa and build a basis to impact practice for PWA. Consequently, this will hopefully improve efforts to effectively address issues facing children, adolescents and young people growing up with the condition.

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How multilevel modelling can improve ground modelling for offshore wind farms

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Keywords: Multilevel, Bayesian, Co-kriging, Offshore wind, Data fusion

Climate change has made moving to renewable energy a race against time. Wind energy is one of the most prominent sources of renewable energy. According to the Office of National Statistics, it has increased its energy output by 715% from 2009 to 2020 in the UK.[1] To build offshore wind farms, a suitable area for the foundation must be found and assessed before construction takes place. In this way, this research will support the change in technology as renewables become the main energy providers.

The most common method for obtaining the necessary geotechnical measurements is cone penetration testing (CPT), however, this is expensive and highly localized. Seismic testing is a popular method used by the oil and gas industries to ascertain the geophysical properties of the subsurface. Seismic testing is cheaper and can cover larger areas. Its use in assisting the mapping out of geotechnical properties would reduce testing costs. This research aims to interpolate geotechnical properties through multilevel modelling.

Currently, the industry standard is to use co-kriging, to interpolate the geotechnical properties. Kriging is to take a mean of nearby points, weighting by a function of distance. Co-kriging is kriging with the addition of correlated data, in this case, geophysical data is used.

Multilevel modelling allows data to be structured hierarchically with clustering of the data. Co-kriging does not offer as much flexibility as multilevel modelling. Co-kriging simply assumes the data sources are correlated while multilevel modelling allows for complex relationships in the levels. Co-kriging compared with alternatives of machine learning has shown to be less accurate. Although, co-kriging does have the benefit of a better vertical resolution. [2] The new multilevel approach should provide more accurate data.

Taking a Bayesian approach means the model takes in parameter uncertainty and allows new data to be included naturally. The new method should be able to predict the most informative place for additional CPT testing, further reducing the cost of the investigation. Multilevel modelling is often used to model air pollution and associated health implications.[3] These however often also model the change over time which is unnecessary for ground modelling. Air pollution models are still relevant to the research as they look to fuse the measurements of multiple pollutants to improve data quality in a similar way to this research, which is looking to combine multiple types of measurements.

Data collected by the renewable energy company, Orsted, will be fitted by the model developed along with co-kriging for comparison. To compare, 'leave one out' validation can then use for analysing the performance of the models' prediction. 'Leave one out' means for each data point, the model will be trained without it and used to predict it. The error can be calculated for each data point, this then allows for the performance to be assessed and compared.

Having a dependable, faster system to inform construction will speed up the build of wind farms and decrease the cost. Having more affordable and plentiful green energy will substantially impact decarbonizing the energy sector. The research may have further implications in spatial data fusion as it will present a new framework for low fidelity data to incorporate into the interpolation of sparse data.

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Being Adult: Breaking Down Core Elements of Aggregate Porn Sites

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Keywords: Information Science, Information Architecture, Porn, Media, Internet

The debate around porn has been a hot topic since the 1970s, with second-wave feminists like Dworkin and Mackinnon paving the way for the anti-porn movement while other female artists and performers fought to have their say. The internet expanded, and aggregate porn websites made the media more widespread than anyone could have imagined. Today these sites are commonplace, and so too are their biases. This study takes an interdisciplinary approach to the debate within today's context. It combines Media Studies and Information Science to examine the site's discrimination against gender, sexuality, and race. The research delves deep into the content of the sites and how their algorithms and recommendations operate. The result will further prove their biases and create solutions, without censorship, to make these sites more acceptable and accepting.

This research aims to have this taboo subject taken more seriously as it is a topic rarely researched due to its taboo nature despite being a large part of the internet. The research will bring up some risqué outcomes born from their lack of attention for so long. It aims to break down these sites into their most common user-generated elements like comments, likes, top videos, recommended content and tags and extract what they contain. The end goal of the research is to spread awareness of how these sites operate, intending to find a way of making them better. As the internet moves towards Web3 semantic web and computers learn from users, this research becomes vital to look at a portion of internet data used to inform computers and how best to tackle any issues that could inevitably arise.

New methodologies in website content reviews will grow from the study and inform future research. These new methods are born from an interdisciplinary approach, creating greater insight into user-generated content for non-typical websites. The porn landscape has changed drastically since the 1970s, just like the internet, yet the research that combines the two has remained stagnant and limited. With this new study, the academic view can better reflect the actual events of society.

COVID-19 Vaccination in Lower-Middle Income Countries: National Stakeholder Views on Challenges, Barriers, and Potential Solutions

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Keywords: Covid-19 vaccination, vaccine hesitance, Lower-middle income countries

The development of COVID-19 vaccines does not imply the end of the global pandemic as now countries have to purchase enough COVID-19 vaccine doses and work towards their successful rollout. Vaccination across the world has progressed slowly in all, but a few high-income countries as governments learn how to vaccinate their entire populations amidst a pandemic. Most low- and middle-income countries (LMICs) have been relying on the COVID-19 Vaccines Global Access (COVAX) Facility to obtain vaccines. COVAX aims to provide these countries with enough doses to vaccinate 20% of their populations. LMICs will likely encounter additional barriers and challenges rolling out vaccines compared HICs despite their significant experience from the Expanded Programme on Immunisation (EPI).

This study explores potential barriers that will arise during the COVID-19 vaccine rollout in lower-middle-income countries and how to overcome them to inform policy makers on where to focus attention to increase vaccination in their countries.

We conducted sixteen semi-structured interviews with national-level stakeholders from Ghana and Bangladesh (eight in each country). Stakeholders included policymakers and immunisation programme experts. Data were analysed using a Framework Analysis technique.

Stakeholders identified key supply-side challenges and barriers to include those related to the health system (e.g., suboptimal cold chain system and surveillance structures, insufficient and inequitably distributed trained clinicians, and top-down mode of planning) and national- and global- level issues (e.g., erratic power supply, poor road networks, inadequate government budget for vaccine purchase, and global vaccine shortages). Key demand-side challenges and barriers discussed are vaccination service-related (sales of vaccines, fatigue due to multiple dosing and travel cost), vaccine safety concerns and social/religious and cultural beliefs against vaccines.

Stakeholders believed their country could use existing EPI structures for the COVID-19 vaccine rollout despite existing challenges with the EPI and despite its focus on childhood immunisation rather than vaccinating the entire population over a short period of time. Stakeholders suggested increasing confidence in the vaccine through community influencers and by utilising local government accredited institutions such as the Drug Authorities for vaccine approval. Additional strategies they discussed included training more health providers and recruiting volunteers to increase vaccination speed, expanding government budgets for COVID-19 vaccine

purchase and delivery, and exploring other financing opportunities to address in-country vaccine shortages. Stakeholders also believed that LMICs may encounter challenges complying with priority lists.

Our findings suggest that COVID-19 vaccination is different from previous vaccination programs, and therefore, policymakers have to expand the EPI structure and also take a systematic and collaborative approach to plan and effectively rollout the vaccines.

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 will analyse the role of entrepreneurship education in developing microbusinesses owned by Omani women by examining the current entrepreneurial sources and their effects on micro-enterprises.

Entrepreneurship awareness is usually associated with the entrepreneurship initiatives and entrepreneurship education programs offered by academic and business institutions (Faghih and Zali, 2018). In Oman, there are eight entrepreneurship initiatives and three business centres (Al-Harthi, 2017) however, all initiatives are based in Muscat Governate, and only 2 out of 6 centres operate in other Governates (Author's adapted from: Intilaaqah, 2018; INJAZ Oman, 2019; Sas, 2020) even though 67% of companies are based outside Muscat Governates (Al-Harthi, 2017; eCensus, 2021).

Though it is still difficult for some rural areas to access these services. These initiatives are targeting similar groups such as jobseekers who are high school graduates, university students or post-graduates (GEM Oman, 2019). The impact is that lesser-educated individuals who want to start a business are more entrepreneurially vulnerable and not exposed to the same knowledge and experiences as their counterparts (ibid).

Furthermore, 28% of female youths (18 – 29 years old) are entrepreneurs (OYDI, 2020). These women entrepreneurs intend to run micro-businesses in female-related sectors such as tailoring, handcrafts, retailing, home-based business, sale of readymade garments and weddings video- and photo-shooting, just to name a few (Ghouse, McElwee and Durrah 2018; OYDI, 2020). The literature demonstrates that women entrepreneurs in rural areas are lacking entrepreneurial knowledge and accessibility to entrepreneurial facilities. Therefore, that hinders them from thriving and scaling up their current businesses. In Oman, there are no entrepreneurial initiatives that target women entrepreneurs exclusively except the ones that are organised by Omani Women Associations (OWA, 2020).

Despite the significant relationship between entrepreneurship education and business development (Al-Harthi, 2017), there has been no research on the impact of entrepreneurship education on microbusinesses in Oman. To that end, this research

will bridge between entrepreneurial initiatives and microbusinesses and examine the practice of entrepreneurship education.

The research will target two segments which are women entrepreneurs and organisations (e.g. academic institutions, incubation centres and Omani Women Associations). Choosing women entrepreneurs will be based on their living areas with the main focus on rural areas. The data will be gathered through three main stages using the following methodological strategies: survey and ethnographic methods, interviews, and focus groups, respectively.

Phase one has been initiated and the results of distributing the questionnaires are quite interesting. The survey has revealed the characteristics of businesswomen in rural areas. They are between 26-35 years old, married, hold a secondary school degree and do not have employees. More interestingly, the majority of respondents did not attend entrepreneurship courses and they are operating their businesses based on experience and self-learning.

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

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Circular Economy in the Oil and Gas Industry

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Key words: Sustainability, Circular Economy, Climate Change, Oil and Gas, Net-Zero

The climate crisis coupled with the fast-growing population, intensive global competition, and utilization of finite resources is indeed a challenge for the human population. This has led to a response by world leaders and most countries to ally and set a target of achieving net-zero emissions and pledged to achieve this by 2050 at the COP26 (Golebiowska et al., 2021). Despite the pledges and the commitment made to reduce GHG emissions toward achieving a low-carbon economy that will minimise the negative impact of CO_2 on the environment. There remains the need to transform business models into more sustainable and resilient ones through other waste by-product opportunities such as recycling, remanufacture, and reuse.

The oil and gas sector is a key contributor to world energy, and it is projected to continue being a major player for some years to come. Hence the need to address the sustainability challenges associated with the oil and gas sector, which include but are not limited to, resource depletion, accumulation of waste, and ecosystem degradation. The circular economy is a model that has been proposed as one of the solutions that will accelerate the industry towards economic and environmental sustainability. A circular economy is an “industrial system that is restorative and regenerative in design” (Ellen McArthur Foundation, 2013). It is a sustainability concept that supports restoration as opposed to the linear “end of life” concept and represents a significant shift from the linear model towards the use of renewable energy sources, use of recycled and non-toxic chemicals, and redesign of products that ensures waste is eliminated and remanufacturing of fixtures that have reached their end of life.

Though there have been studies seeking to identify solutions to the issues highlighted within the sector, the concept of circular economy has a low adoption in the oil and gas industry, and as a result, has not been comprehensively studied. Therefore, this study aims to bridge a knowledge gap by identifying, evaluating, and quantifying the most critical components of the oil and gas value chain that will ensure a successful implementation of the circular economy model in the oil and gas industry and enhance the understanding of the concept by key stakeholders in the oil & gas industry. To achieve this, an investigation of the drivers and barriers to the adoption of a circular economy in the oil and gas sector will be carried out, the relationship and interdependency of the components within the sector will be evaluated, and a quantitative study will be carried out using sustainability metrics to determine their impact in the current linear systems, then an appraisal of the view of key stakeholders on the circular economy model in the industry through a qualitative study.

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Standalone Off-Grid Solar panel System with Integrated Monitoring and Control

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Key words: Standalone grid system, NodeMCU, Arduino, ESP8266 WiFi Module, Battery Monitoring System

In an ever changing world, consistent efforts need to be made when it comes to meeting energy requirements ever increasing population specially in developing world. In order to deal with this problem its not only important to find novel green ways to harness energy but also develop ways through which private enterprises and individuals to monitor their energy usage and also be able to make intelligent decision when it comes to energy wastage. The objective of this project is to develop a system using Internet of Things(IoT) which can retrofitted according to user needs and can help in enabling power usage monitoring and thereby preventing power wastage.

For countries closer to equator, which fall in either developed or under developed categories, such as, India, it is evident that solar energy can is present in abundance, low cost novel ways are required to harness solar energy in such countries in order to minimize their dependence on conventional energy resources in order to achieve net zero targets. In rural settings, where power outages are common, individuals can be encouraged to adopt ways low cost ways. Standalone grid systems can be developed which can enable individuals to produce energy on their own and also enable them with systems through which they can monitor their energy usages and make intelligent decisions when it comes saving energy, thus system developed will not only harness clean energy but will also prevent wastage.

In order to develop monitoring systems for standalone grid system, simpler boards such as Arduino and NodeMCU (Microprocessor development boards with integrated input and output pins) can be used, through which several monitoring nodes(single point responsible for collecting energy consumption data for selected number of loads) can be developed using NodeMCU which consists of a ESP8266 Wi-Fi module (module designed to run on wireless local network protocol). Due to presence of Wi-Fi module a low cost communication can be established with a central Micro-controller Unit(MCU) or Micro-processor Unit (MPU) (Example - Raspberry Pi). Established nodes can be used to exchange data with central control unit and control unit is responsible for processing data collected into meaningful results. This processed information is then supplied the user in form of a data displayed on App, the user then makes an informed decision to actuate certain node in order to avoid energy wastage. Apart from actuating loads battery monitoring systems can also be developed which can enable user to monitor battery storage and judge reliability of battery being used with their off grid system.

MARTINOID: A Peptoid MARTINI Force Field for Antimicrobial Material Discovery

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Key words: Assembly, Antimicrobial Resistance, Molecular Dynamics, MARTINI, Design Rules

Antimicrobial resistance (AMR) is a serious threat to humanity and its prevalence is growing. If left unchecked 'routine' medical procedures, ranging from caesarean sections to chemotherapy will become potentially life threatening through risk of infection: so, the race to develop novel antibiotic materials is afoot.

Peptoids are biocompatible mimics of natural peptides with enhanced *in vivo* stability. They are also antimicrobial and exhibit assembly in water; recently is has emerged that these properties in concert can yield potent antimicrobial activity. We aim to discover short assembling sequences with these properties, of two or three residues in length; these would be simple to make, which is appealing for scale-up and real-world application.

However, how can we discover assembling sequences in a vast chemical search space? To do this we are developing a coarse grain molecular dynamics model in which atoms are grouped into beads, vastly reducing the computational expense associated with simulating their behaviour. We coin this the MARTINOID model, which is a combination of peptoid and MARTINI, the popular force field we are adapting for this purpose.

To retain the intrinsic characteristics of these molecules we use a programme called SwarmCG to capture many dynamic molecular properties in a simplified way. In parallel, representative molecules are being synthesised and a property known as LogP is being measured. This gives an estimate of how a given molecule interacts with its aqueous environment. In this way the model is tuned to reproduce real-life properties.

Once complete, we will screen the assembly of all di- and tripeptoid sequences derived from a total of 33 molecular subunits (37026 molecules). It is expected that many interesting molecules will be discovered in this way, and these will be tested for assembly and antimicrobial activity. With this data design rules for combining these properties will be generated, which will greatly increase the theoretical understanding of small molecule assembly within a materials application context.

Design of “stealth” nanosized particles for DNA delivery to cancer cells

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Key words: Nanosized particles, polyethylene glycol (PEG), DNA, skin cancer

Recently, “seek and destroy” nanosized particles, called DAB, have shown high promises by being able to destroy 90% of skin cancers in laboratory settings following injection in the blood [1]. Their unique “tree-shape” structure protects the DNA they carry from premature degradation, which makes them particularly useful for the transport of DNA in the body. However, these particles can be rapidly eliminated from the body by the immune system while in the blood, which limits their efficacy.

To overcome this issue, it has been hypothesized that attaching a chemical called polyethylene glycol (PEG) to the surface of the particles would make them invisible to the immune system, therefore prolonging their circulation time in the blood and decreasing their degradation. Actually, most of us have already been injected with PEG in the last two years, as PEG-attached chemicals were used in the making of both the Moderna and Pfizer–BioNTech COVID-19 vaccines. Yet, the coating of particles with PEG is thought to have a negative impact on the ability of the particles to carry the DNA and to express it in its therapeutic protein, making it “stealth” but drastically ineffective. The aim of this study was therefore to determine the optimal number of PEG to be attached to the particles, in such a way that they become “stealth” while keeping their DNA delivery efficacy.

The “stealth” particles became significantly less toxic when coated with medium and high numbers of PEG (respectively eight and sixteen molecules of PEG per DAB molecule) [2]. They could carry more than 90% of DNA in all the experimental conditions tested. The carried DNA could be best expressed into therapeutic protein when using low and medium numbers of PEG on the stealth particles (respectively four and eight PEG molecules per DAB molecule). Overall, the best “stealth” and efficacious nanosized DNA particles were obtained when attaching a medium number of PEG to the particles, and achieved a balance between high safety of the DNA carrier, high ability to carry DNA and high ability to express the DNA into its therapeutic protein. These “stealth”, “seek and destroy” particles are therefore promising DNA carriers for cancer therapy.

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Where does insulin signalling intersect with the cellular trafficking machinery?

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Key words: diabetes, adipocyte, cell signalling, glucose transport, caveolae

Insulin is released into the blood following a meal, where it binds its receptor on the surface of fat and muscle cells, activating a chain reaction of signals, resulting in the movement of glucose transporters (GLUT4) from storage vesicles inside the cell, to the cell surface. This process allows glucose into these cells, and it is impaired in people with insulin resistance and Type 2 Diabetes.

Fusion of the GLUT4 storage vesicles with the plasma membrane following insulin stimulation requires the formation of a complex between a number of key proteins: Syntaxin4 (Sx4) and SNAP23 on the cell surface, and VAMP2 on the GLUT4-containing vesicle. Recent work has shown that Sx4 becomes phosphorylated in response to insulin, and that this allows it to do its job. Furthermore, it has been demonstrated that the insulin receptor can directly phosphorylate Sx4 in a test tube. We therefore propose that the insulin receptor is able to directly phosphorylate Sx4 in cells, and that this constitutes a functional link between insulin signalling and membrane trafficking.

Insulin receptors are enriched inside adipocyte caveolae, which are bulb-shaped plasma membrane invaginations that act as signalling platforms. We hypothesise that a mechanism for insulin receptor phosphorylation of Sx4 is their co-location in caveolae. We show that both total Sx4 and phosphorylated Sx4 are enriched in caveolae using phospho-specific antibodies. We use proximity ligation assays to show that the insulin receptor, Sx4 and caveolae components directly interact in the cell, and that these interactions change in response to insulin stimulation. This work contributes to our understanding of the mechanisms that link insulin receptor signalling to GLUT4 trafficking, which will be vital for the development of future therapies for Type 2 Diabetes.

Design of a modern ship recycling yard that can efficiently and sustainably recycle large vessels.

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Key words: Ship recycling, optimization, Sustainability, Efficiency, Discrete Event Simulation

Despite the numerous evident advantages of ship recycling, environmental, health, safety, and regulatory concerns continue to be key worries. In countries where it is most profitable to recycle ships, it is seen as dangerous to health and environment and in other places where it can be relatively safe, it is an expensive process and cannot compete. In effect, recycling yards will need to become both sustainable and efficient. Yards that are sustainable will be those whose recycling efforts protect and do not harm the environment and human health (meaning they are sustainable) and are not incurring cost (meaning they are efficient). It is therefore important to look at how best to improve the recycling process to achieve more efficient and sustainable recycle yards.

Existing literature shows some progress in the optimization of the process to improve productivity; however, they do not consider the type and sizes of vessels recycled tending to generalise all vessel types and sizes with every study without taking into consideration their peculiarities. Each ship is custom designed and manufactured with different materials. This paper aims to develop a ship specific framework for recycling Ultra Large crude carriers (ULCCs) in order to optimise the ship recycling procedures to achieve sustainability and efficiency.

Study will identify different approaches for recycling ULCCs, use discrete event simulation combined with multi criteria decision analysis to establish performance criteria for decision making (e.g. environmental, economic and safety), develop and demonstrate the applicability of an evidence-based framework through a case study. For the simulations to be accurate and successful, significant amount of time will be dedicated on field studies, data collection, observations and expert consultations to be able to create simulation models as realistic as possible with regards to the real-world examples of recycling ULCCs. The amount of data collected from field studies and know-how transferred from experts can be considered as a major contribution as such data was never available at research domain.

It is expected that the results from this research will increase the efficiency and sustainability of recycle yards that dismantle large vessels and improve their recycling processes towards being safe to humans and the environment. The whole method shown in this PhD study is expected to assist the industry to recycle ships more sustainably and efficiently and provide countries, ship recycling stakeholders and policy makers who might be interested in building new sustainable and efficient recycle yards or retrofit existing ones that can handle specific vessels the guidelines to do so.

Impact on Psychological Contract during Organisational Change

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Key words: Psychological Contract, Organisational Change, Exchange, Employment Relationship, Change Management

The contemporary business environment depicts that organisational change is inevitable and effective change management involves strategies which facilitate smooth transitioning during change implementation. Historically, organisational leadership managed challenges posed by external environmental changes through revisions in Business Strategy. However, the progress in the field of Strategic Human Resource Management enabled emphasis on such changes from the HR perspective, thus integrating Business Strategy with HR Strategy. Bringing in massive changes to the workplace, the COVID-19 pandemic led to strategic level changes in business and economy, which greatly impacted the organisations' Human Resources function. A crucial aspect of these changes can be explored through the construct of psychological contract, which has been affected in various ways throughout different stages of organisational changes associated with COVID; both during COVID and post-COVID (the new normal phase).

Originated from Social Exchange Theory, the psychological contract is a multidisciplinary construct which is applicable in the fields of Organisational Psychology, Sociology and Human Resource Management and enhances understanding of the relationship between the employer and the employee (parties to exchange). It is a reciprocal exchange agreement between the two parties which entails subjective terms and conditions to be followed while, relevant to fulfilling commitments towards each other.

In this research, the impact of changes in the workplace on the psychological contract will be studied, in anticipation to positively influence the resultant attitudes and behaviours of employees and employers' agents to maintain a favourable employment relationship. The changes introduced by COVID-19 in the workplace to be explored include uncertainty, remote working, and changes in job roles. With specific emphasis on people in employment, this study aims to identify creative and viable strategies to successfully manage change events, impacting the psychological contract of the parties involved.

This research will undertake a phenomenological philosophy, an inductive approach, and mixed methods to achieve its objectives of analysing the impact on psychological contract during continually changing workplace situation for effective management of the employment relationship. Initiating with semi-structured interviews and focus groups, leading to survey questionnaires, this study will transition from exploratory to explanatory style, ensuring that the purposes of gathering deeper insights and generalisability of findings are achieved simultaneously, thus overcoming

the limitations of each methodological choice through the strength of the other. This research will analyse potential changes in psychological contract regardless of their magnitude, whether certain aspects of the contract change or there is a shift in different types of psychological contract. The findings are expected to make a valuable addition to knowledge because the level and types of change events impacting psychological contract in extant literature are very different from changes experienced by organisations during and after COVID-19.

Robust Optimal Control of Autonomous Underwater Vehicles

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Keywords: Optimal control, Autonomous underwater robots, Model predictive control, Sliding mode control, Parameter estimation

The purpose of this research is to develop an advanced control strategy to achieve effective navigation by autonomous underwater vehicles/robots in the ocean environment where they are used for various applications including inspection and maintenance of offshore structures. The design of these control strategies is challenging because of the high level of complexities in the robot dynamics, fewer control surfaces than is ideally required, physical limits of the available control surfaces along with the fact that the robots are required to operate in harsh ocean environment where sea waves and currents inhibit their steady motion. Moreover, velocity sensors are expensive to install in underwater robots, making the average autonomous robotic system to be designed without velocity sensors. Since advanced control methods typically lead to state feedback laws where linear velocity measurements must be known to achieve control, techniques to obtain these velocities are a necessity. In this circumstance, control designers are left with the option of deploying observers or approximators to estimate these velocities as unmeasured system states. The accuracy of the estimates is usually degraded by unavoidable sensor noise and the inaccuracies of available dynamic models of the underwater robots. A consequence of the degraded velocity estimates is reduced controller effectiveness that in turn hamper smooth operations of underwater robots.

Motivated by these challenges, this study aims to develop a simple but efficient analytical technique for the determination of the velocities of robotic systems based on available measurements. Analytical determination of these velocities means that their accuracies will be independent of the accuracy of the dynamic models of the robots. This development has significant implications for not just the control of motion systems (like underwater robots) but also for the advancement of sensor technology. With respect to sensor technology, it would make it possible to be able to combine displacement and velocity sensors in a relatively simple design since the proposed analytical method shall rely on the measurement of displacements of underwater robotic systems. In control, the challenge of minimising the detrimental impacts of poor estimates would have been adequately addressed. Consequently, encouraging the deployment of advanced state feedback control laws (*e.g.,* model-based predictive and sliding mode controllers) for the control of these systems.

Based on this advancement, an advanced control architecture that combines the relative advantages of model-based predictive control and sliding mode control techniques shall be designed. The merits of model-based predictive control which the developed control architecture shall aim to maximise are its ability to naturally incorporate the physical limits of engineering systems in control design while ensuring

stability and optimized performance of the controlled system. The inherent high level of robustness of the sliding mode control method to inaccurate dynamic models and external disturbances such as those induced by sea waves and current can then be into the proposed optimal combined control strategy. Extensive simulation experiments shall be performed to demonstrate the merits of the developed techniques as a necessary step before actual deployment in an existing underwater robotic system. The overall implication of the research would be the availability of high reliability and optimal functioning underwater robots for applications in offshore renewables, environmental monitoring, subsea infrastructure inspection, maintenance and repair. In addition, other motion systems can be designed with better navigation features through the use of the analytical velocity estimation.

Identifying Impending Asset Price Crashes and Regime Changes Using Topological Data Analysis

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Key words: Topological Data Analysis, Financial Risk, Regime Changes, Crash Detection, Market Analysis

We use topological data analysis (TDA) to identify signatures of upcoming price declines in assets by identifying changes in the topology of momentum, volatility, trend, and volume indicators. The technical indicators are based on the daily closing price of S&P500 components for three periods of significant declines in the market: the dot-com crash, the financial crisis and the Covid-19 pandemic. This research builds upon previous work of TDA within finance based on Sato (2016), Gidea and Katz (2018), and Majumdar and Laha (2020). We find a strong relationship between the persistence of topological features such as homological loops and declines in asset prices. In this manner, we explore the use of Betti numbers which summarizes the topological features of the data in detecting impending regime changes of asset prices. We evaluate the usefulness of several features derived from Betti numbers such as the number of loops, their maximum lifetimes, the average lifetime of loops. Through these topological features, we apply changepoint detection methods to determine impending changes on asset prices. We propose a leading indicator of price changes in assets which complements existing methodologies for asset analysis and can be used as an early warning signal of impending regime changes. This approach can have several implications within asset management including the development a TDA based risk assessment model as well as risk-based asset allocation techniques.

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Development of Lightweight & Fireproof Battery Enclosures for Electric Vehicles

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Key words: Composites, Lightweight Materials, Battery Enclosures, Fire Safety, Electric Vehicles

Battery electric vehicles (BEVs) have emerged as one of the most promising technologies for enabling a low carbon future in the automotive sector - releasing no emissions during their operation. However, the charging time and driving range presents a major challenge which is not helped by the fact that these vehicles are very heavy. A handful of incidents have also stressed the need for protective measures as batteries - particularly lithium-ion used in BEVs - can pose a fire risk if subjected to temperatures beyond their safe operating temperature, overcharged, or mechanically impacted. Abnormal operating conditions and overcharging can trigger a reaction called “Thermal runaway” whereby the battery cell undergoes an uncontrollable increase in temperature. This often leads to the release of toxic gases, smoke, and a jet flame fire which can exceed temperatures of 1000˚C. Therefore, there is a need to ensure vehicle occupants safety in the event of thermal runaway and fire breakout from the battery.

Composite materials, such as carbon fibre reinforced plastic, may help to address these challenges. Composites have been used extensively in the automotive sector for applications such as body panels and interior materials. Their low density, and high strength-to-weight ratio can help to achieve significant weight savings and enhanced performance. With the rise in BEVs entering the market, lightweight design has drawn focus towards the battery housing itself, which can often add unnecessary weight to the vehicle. For that reason, there has been significant interest in the application of composites for battery housings/enclosures for BEVs. To date, a handful of researchers have demonstrated that replacing high density metallic materials with composites may help to achieve enclosure weight savings of 40%. With that said, very little research has explored the ability of composite enclosures to act as a fire barrier against battery cell/module fires. This research aims to explore the fire safety and fire resistance of composites typically being considered for enclosures. This will be done using numerical models and experimental fire tests. In addition, the manufacturability, cost, and environmental aspect of potential fire protective composite enclosures shall be explored to ensure the solution is suitable for industry.

The research will hopefully provide automotive companies with a guide on how to manufacture lightweight battery enclosures that offers additional protection against the dangers of thermal runaway. So far, numerical modelling and data from the literature review has made apparent that composite laminates can offer good fire shielding. With that said, significant heat is transferred through the thickness of the

laminate which results in a significant reduction in load carrying capacity. A method to limit this without compromising weight savings may be to incorporate a low thermal-conductive rigid core material between the composite layers; however, this solution may pose limits on the final shape and manufacturability of enclosures.

Becoming a Leader: Exploring the Experiences of Aspiring Leaders in Scottish Schools

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Key words: leadership, education, identity, emotion, leadership preparation

This study explored the experiences of aspiring school leaders in the Scottish context as they undertook a formal leadership qualification. Participants were Scottish school teaches working in both formal and informal leadership positions that were undertaking a part-time Masters programme of study. The exploration was undertaken in order to better understand how the participants' perceived themselves as leaders (their leadership identity) when interacting in their workplaces. How this identity was also developed and influenced over the period of their participation with the programme was considered. This led to a deeper understanding of their personal development as leaders and hence, how this might influence and inform leadership preparation.

A constructivist comparative case study which used aspects of a grounded theory approach was employed in order to explore the interaction of identity and identity formation with emotional competence (emotional intelligence). A theoretical framework that combined the Profile of Emotional Competence (PEC) (Brasseur et al., 2013) and the Personality and Social Structure Perspective (PSSP) model (Côté & Levine, 2002), provided the basis for the design of the data collection and subsequent analyses. Critical reflections on their work as leaders were collected from four part-time university students over a period of two years, who were continuing to work as teachers in Scottish schools.

Findings showed that there was indication of the interplay of emotional competence and identity formation. Students' sense of identity as a leader acted as an important point of reference for them and consisted of a belief in improving teaching and learning (and linked to this), a belief in improving student outcomes, a requirement for technical expertise, and a requirement to maintain a calm and purposeful demeanour. This aspect of the participants' identity appeared to be influenced by confirmation from more senior leaders of their actions, positive impact of their actions, improvement as a consequence of leadership actions, and wider reactions from colleagues during interactions.

Conclusions were used to construct a series of recommendations, offered to those involved in the education, support and policy making that influences the development of teachers as leaders. In terms of supporting developing leaders this should be a career long endeavour that celebrates diversity, strengthens emotional competencies, allows leaders to consider their own values and gives time to acquiring technical knowledge.

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Computing the Free Energy Change of DNA Hybridisation Using the Jarzynski Equality

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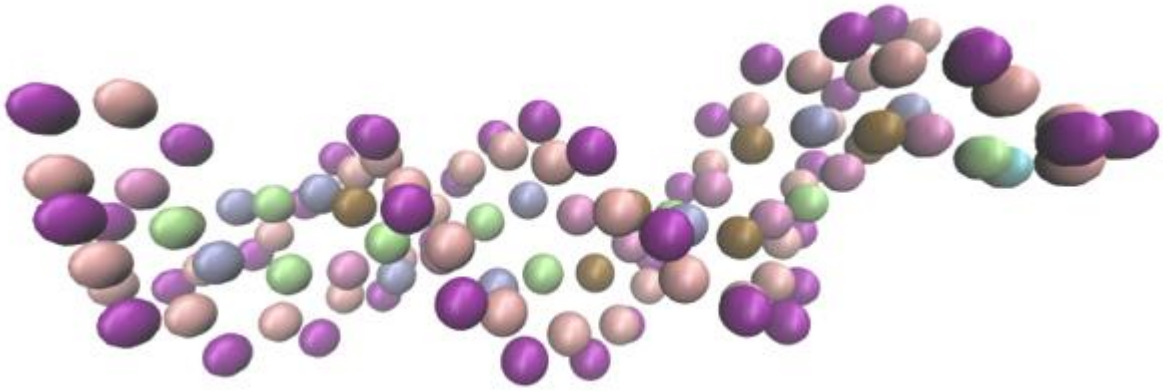
Key words: DNA, Molecular Dynamics, Coarse-grain, Jarzynski Equality, Machine Learning

Understanding the physical processes by which two single strands of DNA bind to one another to form double stranded DNA is important in a wide variety of applications, from healthcare, to agricultural science, to designing new nanoscale devices [1-5]. Computational models provide an effective way of studying DNA strands and determining their sequence-dependent behaviour. DNA can be altered through damage, mutations, and manual modifications, so the number of permutations of DNA is effectively infinite. Hence, the development of a standardised methodology for the study of the physical processes of DNA is vital. In this work, two coarse-grain simulation methods are used to perform steered molecular dynamics simulations to separate two bound DNA strands [6,7].



Rather than using an atomistic approach, in which each individual atom is simulated, a coarse-grain approach was utilised to simplify the molecular system, reducing computational expense. For each method, the irreversible work done to perform this action is measured over a large number of simulations. The Jarzynski Equality [8] is then used in order to obtain an approximation of the free energy change for hybridization of the two DNA strands. An extensive comparison of the two methods has been undertaken to determine which is most appropriate in the use of DNA simulations. A machine learning model will then be trained to replace the Jarzynski Equality with the aim of providing a more accurate approximation of free energy changes.

By utilising cutting-edge machine learning technology, this work aims to increase the accuracy at which DNA binding is predicted. A better understanding of

DNA has a particularly positive impact, for example, in the healthcare industry, aiding in the fight against cancer and other diseases; however, physical experimentation can be a lengthy and expensive process. Thus, a robust method of simulating DNA behaviour and determining its properties will be hugely beneficial in gaining a deeper understanding of the role DNA has in modern technology. In an increasingly digital world, machine learning has emerged as a rapidly evolving technique that is revolutionising the development of highly dependable predictive computational models.

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Improving cybercrime reporting in Scotland: A systematic literature review

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Key words: Economic cybercrime, Responsibilisation, Taxonomies, Scotland, Literature review

Background: The UK system for reporting economic cybercrime is called Action Fraud (AF). AF has been found to prioritise high value and low volume crimes. Therefore, people who have been scammed out of less than £100 000 are less likely to have their crime investigated via AF. Consequently, Scotland severed its ties with AF and proceeded to develop its own systems for reporting low value and high-volume crimes. Another problem with AF was that its reports were inaccurate and incomplete. Interestingly, since the 1930s the compilation and investigation of crime reports has always suffered from inaccuracies and discrepancies. This pattern has not been reversed by rapid technological development. Instead, the trend is preserved, not just in the UK, but across the globe.

Aim: An exploration of how to improve cybercrime reporting in Scotland was implemented via a systematic literature review the results of which will inform upcoming fieldwork. Due to the lack of data on Scotland, frequent extrapolations were conducted from both the UK and the West. The research questions were: 1. What is known about cybercrime in the UK to date? 2. What is known about cybercrime victims in the UK to date? 3. What is known about cybercrime reporting to date?

Method and Analysis: The answers were retrieved by combining Boolean variables with keywords into Scopus, Web of Science and ProQuest. This resulted in the inclusion of 100 peer-reviewed articles (after the exclusion of unsuitable ones). The articles were analysed using Inductive thematic analysis (ITA). The underlying principle of ITA is based on data immersion to identify the themes within. This analysis revealed a common trend, a novel taxonomy, and an original conclusion.

Results: The common trend is that of responsibilisation, which is the shifting of responsibility for policing cybercrime from the government onto the citizens and private sector. For example, the government educating citizens about the risks of cybercrime and disengaging with them thereafter is a case of responsibilisation. This is because the government sees it as the victims' responsibility to follow its advice. One problem of responsibilisation in cybercrime is that if one person is attacked, then many computers can become infected through their error. Therefore, the government should step-up to the task of protecting its citizens. The novel taxonomy is for classifying cybercrime reporting systems according to three pillars, which I referred to as Human-To-Human (H2H), Human-To-Machine (H2M) and Machine-To-Machine (M2M). The advantage of this classification is parsimony, the disadvantage is reductionism. The risk of reductionism applies specifically to crimes that sit in between pillars.

Conclusion: To improve cybercrime reporting in Scotland, the process needs to be treated also as a social one rather than a purely mathematical one. This can be achieved by engaging with psychological principles of how emotionally charged social interactions are encoded into memory. Understanding memory will help the police record cybercrime reports in an effective way. This research will impact society because it serves as a foundation for fieldwork with victims of cybercrime and the police tasked with those investigations. The results of the upcoming fieldwork will serve to inform national guidance on how to improve the reporting of cybercrime, which will reduce it and give victims living in Scotland a sense of closure.

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People Management perspective on Dynamic Capabilities in High-Tech Startups, specifically in the UK Space Industry

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Key words: Dynamic Capabilities, Human Resource Management, Employee Perspective, Startups, Space Industry

Dynamic Capabilities (DC) are the next-level functions that allow organisations to stop surviving and begin thriving. They are the organisation's capacity to innovate and adapt the resource base addressing and shaping the surrounding business environment rather than simply existing. For many years, the research on Dynamic Capabilities has been strictly managerial.

> A strategic perspective connects Dynamic Capabilities and Human Resource Management (HRM). And this connection, in turn, unlocks Employee Dynamic Capabilities (EDC) - a unique outlook each employee brings and what they can do to support the dynamic capabilities of an organisation.

The focus of EDC is on sensing opportunities. HRMDC should create systems and practices that empower employees to come forward with their ideas, and a way said ideas would be processed. The effectiveness of HRMDC is calculated through organisational innovation, agility, and pivoting.

Employee DC is a new concept; the connection between Dynamic Capabilities and HRM is under-researched. Dynamic Capabilities are best researched in dynamic environments, and the DC of startups are yet to be investigated. Hence, the vastly paced Space Industry has been chosen for research.

Next Generation Retinal Screening

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Key words: Retinal Imaging, Diabetic Retinopathy, Self-Operated, Indirect Ophthalmoscope, Teleophthalmology

Diabetic retinopathy is a complication of diabetes that attacks the blood vessels in the back of the eye (retina). If left undiagnosed, this could result in irreversible vision loss. Therefore, the NHS requires that people suffering from diabetes have annual screenings to examine the retina [1]. This creates a strain on the NHS, with the number of people with diabetes predicted to reach 5.5 million by 2030 [2]. The screening uses bulky and expensive equipment, making it inaccessible in resource-limited areas. With the abundance of smartphones, retinal imagers have been developed using their cameras [3, 4]. This allows the screening process to become more portable and more accessible. However, these imagers do not address the load on the NHS as they still require a trained operator to take the image.

This project aims to create an adaptor and app that will allow self-operated, smartphone-based retinal imaging to diagnose and monitor diabetic retinopathy.

The imaging system is based on an indirect ophthalmoscope. Which is a beam of light and a strong magnifying lens aimed at the eye to allow the operator to see the retina. The magnifying lens is a volk 90D lens, commonly found in clinical settings. It is positioned 10cm away from the back facing camera. This was determined by adjusting the distance between the lens and the camera until a model retina was in focus. To create a system that is more self-operated, a point for the patient to fixate on was designed. This will allow the patient's eye to align with the system more easily when taking the image. To achieve this, a periscope styled system has been introduced to work alongside the imaging system. It is positioned between the camera and the magnifying lens and branches downwards from the imaging system. At the bottom of the periscope is a small screen, TinyScreen+ (TinyCircuit, USA), which shows a red dot for the patient to fixate on.

Once the periscope has been fined tuned, a light source will be introduced to allow enough light to reach the retina and image it. From there an app will be designed to take, and safely store the images. The device will then be assessed on its usability and its ability to diagnose and monitor diabetic retinopathy by performing trials. First on healthy users and then patients with diabetic retinopathy.

If this project is successful, it will create a way for diabetic patients to take an image of their own retina without supervision. With the device being portable, the screening process would become more accessible, with the patients being able to use the device at home or in a hospital setting. It will also aid in reducing the load on the NHS by removing the need for a trained operator.

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A Systematic Review of the Integrated Motivational-Volitional Model of Suicidal Behaviour

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Key words: Integrated motivational-volitional model, suicide, risk factors, theory, systematic review.

Background: Per year, over 800,000 individuals die by suicide (World Health Organization, 2014). Identifying the risk and protective factors and investigating their interactions could help develop effective methods for screening of suicide risk and inform interventions for individuals at different levels of risk (Steele et al., 2018; World Health Organization, 2012; O'Connor & Nock, 201). Theoretical models of suicide aim to explore the associations between various risk and protective factors and how these may result in suicidal thoughts and behaviours (intentional infliction of harm to oneself) (Turecki & Brent, 2016).

The integrated motivational-volitional (IMV) model of suicidal behaviour is one of the most comprehensive ideation-to-action models that accounts for biological, social, psychological, and contextual variables that may impact suicide risk. This model proposes that suicidal behaviour arises from 3 distinct phases (O'Connor & Kirtley, 2018; O'Connor, 2011). The pre-motivational phase consists of the background variables that increase vulnerability to motivational phase variables such as genetics or life events. The motivational phase explains the processes leading to suicidal ideation. The volitional phase explains the factors facilitating the transition from suicidal thoughts to action.

Identification of individuals at a risk for suicide and developing effective interventions is critical to suicide prevention (Dunlap et al., 2019). In the decade since the IMV model has been proposed, it has influenced the development of screening tools for suicide risk (De Sousa et al., 2020) and interventions (O'Connor et al., 2017). However, the supporting evidence for it has not been systematically synthesized and evaluated. Synthesizing the literature on the topic could inform directions in practice and research in suicide prevention, identifying risk, developing interventions, and highlight gaps in research needing further investigation.

Aims: This systematic review aims to synthesise, review and critically evaluate the literature testing the Integrated motivational-volitional model of suicidal behaviour.

Methods: The current systematic review primarily used forward citation mining to identify papers that have referenced the papers proposing the IMV model. PsycINFO, EMBASE, PubMed, Web of Science, and Google Scholar were searched using their citation mining tools for all documents referencing the mentioned papers. Empirical papers originally in English were included if they were testing the associations hypothesised by the IMV model. The included papers will be grouped for

synthesis based on the specific associations tested and study design. Quality assessment will be undertaken using a pre-piloted tool and the results will be reported using the PRISMA guidelines for reporting systematic reviews.

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A Reliability Focussed Approach to the Design of Electrical Power Systems in More Electric Aircraft

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Key words: More-Electric Aircraft, Aircraft Power Systems, Reliability, Power Electronics, Transportation Electrification

Introduction : Electrification of aircraft is a proven means of reducing the carbon emissions in the midst of a global climate emergency, from an industry that is heavily reliant on fossil fuels. The More-Electric Aircraft (MEA) sees traditionally heavy and inefficient systems replaced by electrical equivalents. This has many benefits, including the increased efficiency of the turbofan engines and the improvement in maintenance schedules. There are currently two in-service examples of MEA in the Boeing 787 (B787) and the Airbus A380 (A380), which are acting as stepping stones on the pathway to increased electrification within the aerospace industry. The trend in the increasing levels of electrification in aircraft is seen in Figure 1.

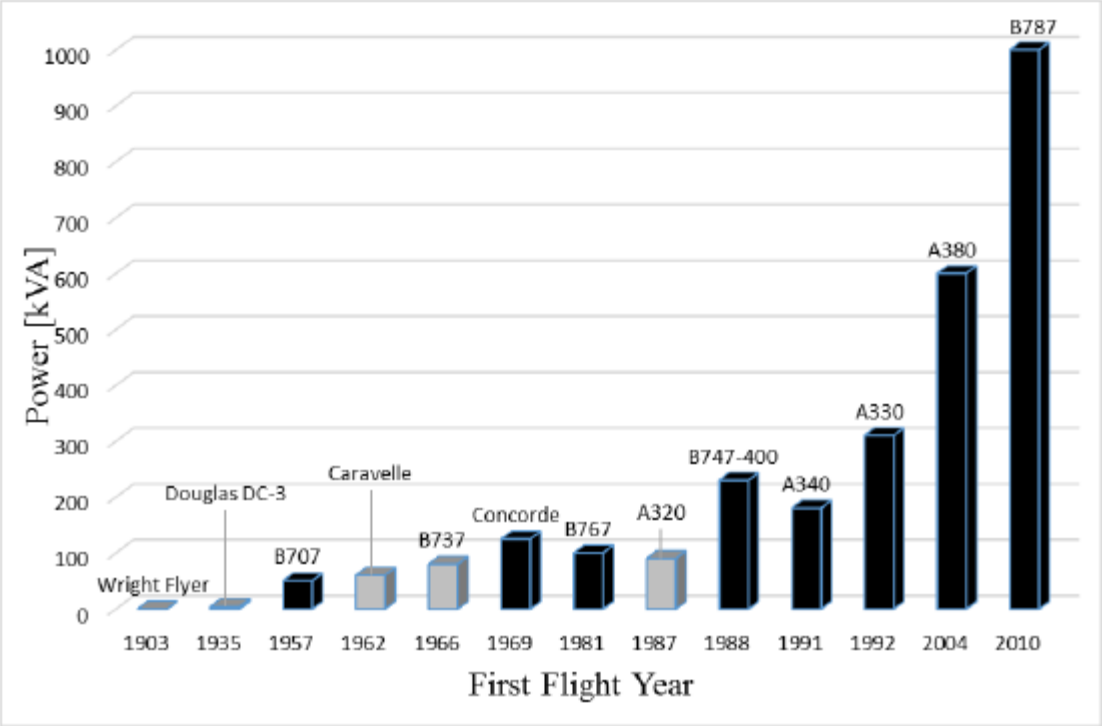

Figure 1. On-board electrical power generation capabilities throughout history [1].

Research Motivation and Output: Despite the environmental benefits of the MEA, there are significant challenges to overcome in regards to the Electrical Power System (EPS) onboard. With the replacement of tried and tested pneumatic, hydraulic

and mechanical systems with equivalent electrical systems, new design and certification challenges are forthcoming. One of these challenges is the likelihood of there becoming a higher penetration of flight-critical electrical systems, hence it is necessary to ensure that stringent certification standards are maintained during this transition. Concurrently, increasing redundancy to improve reliability generally increases system mass, and hence this results in an increase in fuel burn. As such, there is a need to ensure that the EPS is suitably resilient and reliable but balanced against the expense of efficiency and economic viability.

From the literature, it is observed that a system is only as reliable as its least reliable component, which in this case is the power electronic converters (PEC) [2] [3]. As such this research has taken on a focus that is to understand and quantify the probability of failure of the EPS and improvement margin PEC reliability need to improve to reduce the safety criticality to the system. Furthermore, through this work, the current landscape of research addressing the improvements made in PEC is addressed to fully understand the impact at the system level. The work focuses on the increasing penetration of flight-critical electrical loads within the aircraft, not only in MEA, but looking ahead for future electrification concepts such as the all-electric aircraft and electrical vertical take-off and landing air taxis.

Research Impact and Output: This research seeks to understand the application of the current state-of-the-art technologies in aircraft electrical system, to ensure that the future generations of aircraft can exploit technological advancements to ultimately drive down carbon emissions from an industry that, in 2019, provided 2.8% of the global CO_2 emissions [4]. This work will present the current landscape of the literature, provide analysis of the current MEA EPS from a reliability perspective and provides a discussion on architectural design decisions to ensure that the current stringent safety standards can be maintained whilst electrification in aerospace continues to expand.

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Coherent Manipulation of Quantum Dot Spin State Systems

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Key words: Quantum Dots, nanoscale devices, coherent control, quantum information processing, quantum communications

The previous century marked the advent of quantum mechanics as a physical theory to describe the world, leading to a deeper understanding of fundamental physics as well as a vast number of technology-related advancements. Whilst originally believed to exist only as *gedankenexperiments* (*thought experiments*), many physical systems have become realised from research laboratories to industry, fabrication and finally to the technological world around us today.

Our research looks to continue this trend, by demonstrating manipulation and control of individual quantum systems. Where our aims are both towards fundamental physics and further applications in quantum information processing and quantum communications.

Quantum dots are nanoscale semiconductor devices fabricated to generate individual quantum systems capable of trapping and confining a range of particles such as electrons, holes and more complex particles called excitons. This confinement leads to a system that, with the right approach, can be coherently manipulated to allow one to use the system for purposes such as coherent control[1], single-photon generation[2] and information processing.

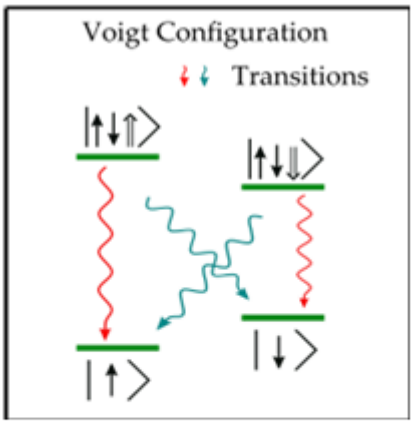

Figure 1: Typical level structure for charged quantum dots in the presence of a magnetic field in the Voigt configuration.

When particles are confined within a quantum dot, they exhibit a discrete energy level structure. It is this level structure of quantum states that allows one to probe the physics inherent to the system and shows promise for future applications.

Of particular interest for our research are *charged* quantum dots, containing an additional positive or negative charge, allowing for a particular orientation of discrete states known as a double-Λ (-lambda) system when in the presence of a strong (in our case, up to 5 T) magnetic field. This configuration is known as a Voigt configuration, related to the direction of the applied field.

Figure (1) highlights the double-Λ system of quantum spin states within a charged quantum dot, yielding four states in total with a number of transitions and emission lines. We have two lower spin states denoted

$|\uparrow\square\rangle \quad \uparrow$

and

$$|\square\downarrow\rangle, \quad \downarrow,$$

with the upper states, known as trion states, denoted

$$|\uparrow\square\square\downarrow\Uparrow\Downarrow\rangle \quad \uparrow\downarrow\Uparrow$$

and

$$|\uparrow\downarrow\Downarrow\rangle . |\uparrow\downarrow\Downarrow .$$

As part of our research, we look to demonstrate coherent control with this system of quantum spins. This involves a series of experiments that highlight manipulating and controlling different aspects of the system, the most recent demonstration was a technique called *spin pumping*[3][4]. A technique that involves deterministically initialising our system into the lower spin states shown in the figure (1).

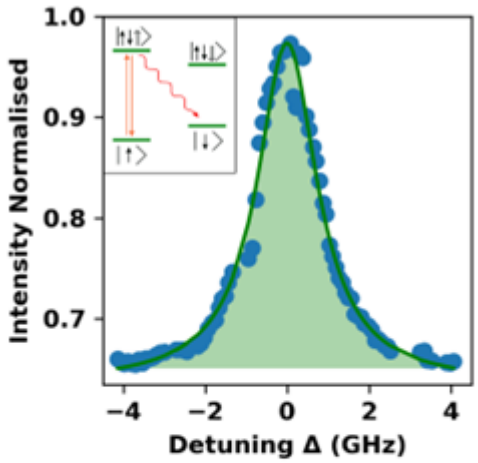

Figure 2: Experimental data of a spin pumping where as the laser is detuned across resonance the emissions towards the transition is greatly increased, showing population of the spin state $|\downarrow\rangle$.

DiVincenzo, a physicist, has become renowned for stating his *criteria on quantum computation*[5], where a set of guidelines, requirements and issues that one would face when physically realising quantum systems for computation were laid out.

One of the criteria stated, for any quantum system to be developed for information processing purposes, it should be possible to *initialise the system into an initial state*. Spin pumping is an attempt to show that in some sense we can demonstrate fulfilling this criterion and highlight the possibility of using charged quantum dots for information processing.

Through resonantly exciting one of the transitions in figure (2) with a laser of the same wavelength, one can succeed at pumping the system into one of the spin states. Figure (2) shows the increase of emission towards a particular spin state as the laser is swept across resonance (also known as detuning the laser), showing the ability to deterministically load the system into what we could call an initial state.

As stated in the beginning, our research aims to continue the trend of advancing both fundamental physics research and mediate towards physics-focused applications with quantum systems. Looking to further the advancement of modern-day technologies in an ever-changing world. Whilst these steps are but incremental, it is the momentum associated with each step that yields improved future technologies.

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The Tendency and the new era of Liability for damages caused by Robots

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Key words: Robots, Artificial Intelligence, Tort Law, Civil liability, Product liability

The idea of Robotic or Artificial Intelligence of Autonomous Robot was once a dream of humans, and in the present, humans have come farther than they expected. A lot of knowledge was created during WWII and led to more advanced technology. The well-known history is the story of Alan Turing, who invented the digital computer and now becomes known as “artificial intelligence” in what was the leading technology at that time.

Nowadays, there are lots of types of Robots, and some kinds of them are well-known and more popular. Self-driving cars are one of them, they are the dream of contemporary scientists. They create Robots with the aim of reducing the number of traffic accidents, and traffic congestions that are caused by the improper behaviors (poor decision-making in driving) of human drivers. Meanwhile, in health care industries, Robot-Assisted Surgery, Virtual Nursing Assistants, and Administrative Workflow Assistance are created with the potential to help more people to access high-quality health services.

Nevertheless, setting Goals or Rules that would be suitable for all Robots or AI seem to be complicated matters for scientists and specialists all over the world. This is especially so because Robots are not just mere machines, like a washing machine or a pocket calculator, they are autonomous machines that can “think” and react to situations on their own. In modern AI with high standard technology like “Machine Learning”, their algorithms could improve through experiences. How can people control these kinds of machines? It is an important task for lawyers and policymakers to deal with.

Because in the present, Robots are autonomous machines. They came from machine learning technology in which they could continue to learn, in addition under the deep learning technology they could develop their own decision. They do not depend on previous data of the manufacturers, even outside the scope of knowledges of the owners. They could be programmed to serve humans to the absolute target, but the method depends on their own decision. For that reason, Robots with Artificial Intelligence create problems in allocating liability and responsibility, which is imposed without consent on the wrong-doer. When Robots act or malfunction, someone will be held responsible for their actions for example; manufacturers, designers, maintainers, modifiers or owners – if these actions amount to a legal wrong, or breach of duty.

Regardless of how Robots become part of people’s lives, they also give rise to complicated questions in society. Currently, Robots are sufficiently sophisticated, that

the time is right for the law to address how their behaviours and decision-making are properly responded to in legal contexts.

Tort law is the main action by which civil liability is imposed for wrong-doing. It means that the reasonable person should be liable when he or she breaches the duty of care that they owe to the claimant, and causes loss, injury or damage thereby to the claimant. The standard that is used to determine this may be referred to as “the reasonable person standard.”. It is a widely held view that the law tries to settle the objective standard. The question is how tort law could settle the standard for Autonomous Machine as Robots.

As mentioned above, there are several questions that have arisen in the past decade. Academics have widely discussed whether the law of tort as it has applied in the past still can be adapted to the new generation of machine whether the innovation could affect the applicable of laws. It is suggested that it is important to promote new laws in robotic liability, maybe it could adapt to the traditional tort, and strict liability of product liability as well. On the one hand, it may possible to create new statutes specific in this field.

This thesis will identify all the various types of legal wrongs that could be found in both negligence and intentional tort focusing on physical harm in the technology that humans have now and will have in the future. It leads to the result of the research in providing new suggestions for the interpretation of tort law or a new draft of the statute relating to the liability of Robots.

Life-cycle carbon and cost comparison of mooring solutions for 15MW Floating Offshore Wind turbines

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Key words: Mooring system, Floating Offshore Wind Farms, Life Cycle Assessment, Life Cycle Cost, Geographical Information Systems

In the race to a net-zero economy, society is experiencing fast-paced technological innovations especially in the energy sector. Particularly due to the abundant wind potential at sea, the offshore wind power market has expanded significantly in recent years [1]. The emerging floating offshore wind farms (FOWF), with several pilot projects operating around the UK (e.g., Hywind and Kinkardine) brought advantages over the fixed bottom ones, as turbines can now reach farther locations offshore that offer better wind potentials. Although this is encouraging, the projects still require materials, marine operations and logistics strategies that are intrinsically carbon intensive. Therefore, in the urgency of reducing the greenhouse gas emissions worldwide, developers of FOWF projects face the challenges of minimizing emissions from their life cycles (manufacturing, installation, maintenance, and decommissioning), where decisions at early design and planning stages play an important role. However, as the FOWF projects are still at its infancy, up until now it is unclear which project designs, operations and sites offshore will generate the least carbon emissions while also offering the best reliability and costs indicators for developers.

Several new floating projects have been announced to be completed by 2030, which will place the turbines at deeper water depths, demanding large floating platforms and long mooring systems. The later, represents thousands of kilometres of heavy lines that connects the platforms to the seabed, which usually are made from large steel chains or synthetic ropes. These systems designs can also be hybrid in materials, varying in diameter and shape (e.g. catenary or tension legs) to offer the safest and cheaper mooring solution for the specific project location, remaining on the developer the responsibility to choose which design approach would be most suitable. However, priority has been given to mooring solutions that fulfil de developer's budget and reliability requirements, while their carbon emissions have not yet been assessed in a comparative way. For this reason, the current stage of the floating wind projects in the UK opens an opportunity for the sector to have improvements in its sustainability indicators along the whole life cycle if the carbon emissions start being considered at the project's planning and mooring design optimisations.

In this context, the present research intends to narrow the knowledge gap on the carbon emissions of FOWF life cycles by comparing the contributions from different mooring strategies available. An initial comparison made for a catenary steel chains and polyester moorings designed for a large 15MW turbine at the same platform located at the same site, showed that the later type of material can be

advantageous in terms of carbon emissions, contributing 7% less to climate change impacts, mainly due to its decrease in steel processing requirements. The Life Cycle Assessment (LCA) methodology was used, as it is widely recognized as the best approach to estimate the emissions of any product system, especially when coupled the commercial database Ecoinvent, which covers most flows and processes from the essential fields of energy and material production worldwide [2]. The presentation will summarize these results and challenges of the next steps during the PhD journey to scale up the methodology of LCA for a wide variety of scenarios and add cost figures to the carbon emissions. It is expected that results and the proposed methodology can foster decision making processes towards lowest carbon emissions in the short and long term for FOWF projects.

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Relationships amongst older adults' cognitive and motor speech abilities: a systematic review

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Key words: healthy ageing, cognition, speech production, mild cognitive impairment, interdisciplinary

The world's population is ageing. By 2050, people aged over 60 will outnumber children and young adults. Persons in the "oldest-old" category, aged over 80, are expected to reach 434 million, tripling from 125 million in 2015 (United Nations, 2015). The UN has declared the Decade of Healthy Ageing (2021 – 2030) to prompt a global collaboration to improve the lives of older people. This interdisciplinary research aims to foster healthy ageing by furthering knowledge about changes to - and interrelationships between - cognition, speech production and social participation in older age, which are all fundamental to ageing successfully. A systematic review was conducted as the initial stage in meeting the above aims with the objective of determining whether a relationship exists between cognitive and motor speech abilities in older adults.

Successful communication, central to daily living requirements, relies on both speech and language production. Language involves producing words and sentences to convey a message whereas motor speech is the tool used for expressing verbal language. Motor speech involves part of the nervous system - the motor system - that controls voluntary movements to produce sounds that are processed and perceived by listeners. Relative to young adults, older adults typically produce slower and less accurate speech. However, research shows that physiological degeneration to the speech system (e.g. larynx, vocal cords) only partially explains these motor speech changes (e.g. Sadagopan & Smith, 2013).

Ageing is also associated with gradual declines to core cognitive abilities including memory, attention, and speed of information processing. It is speculated that cognition is involved in motor speech production, however, there is no clear consensus on which, and to what extent core cognitive abilities account for the ageing of speech production. This systematic review is the first to gather and evaluate the existing evidence on the potential role of cognition in motor speech production in ageing.

Search terms related to cognition, speech, and ageing were entered into four databases (PsychInfo, Web of Science, PubMed & Cochrane Library). Over 12,000 records were screened for potential inclusion. Thirty-two studies, published between 1987 and 2021, were identified and included in the systematic review. Included articles contained behavioural evidence investigating relationships between cognitive and motor speech abilities in healthy older adults and those with Mild Cognitive Impairment (MCI) aged over 60.

The results suggest that there may be general and/or specific relationships between cognition and motor speech. The most robust relationship identified was between attentional functioning and speech in healthy older adults across 10 studies. This demonstrated that when attentional demands are high, such as when talking while walking, or talking while completing a cognitive task, speech is negatively affected, resulting in slower and less stable sounding speech. In MCI, a relationship between long-term memory difficulties and increased pausing in four studies suggested problems with language production (e.g. word finding) rather than motor speech. Relationships between other cognitive abilities (e.g. processing speed) and speech were also observed, but the evidence was limited in quality and quantity, and general measurement issues meant that few studies contained high quality evidence. Further research administering a range of cognitive and speech tasks is required to aid understanding, particularly as both cognition and speech are important for successful communication, social engagement and adjusting to health and lifestyle changes.

The current research applies to changes we are seeing in people. For the first time in history, most people will live into their 60s and beyond (WHO, 2015). Thus, there is a need to identify health outcomes that might prevent individuals from living fulfilling lives, for example, withdrawal from society due to cognitive and/or communicative changes. This systematic review provides initial understanding and a basis for future research to investigate relationships between cognition and motor speech changes. Along with the development of interventions, this knowledge will help older adults navigate lifestyle changes and contribute to society in many ways.

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Development of a micro-vascularised liver-on-a-chip

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Key words: Tissue engineering, Vascular engineering, Microvascularisation, Vasculogenesis, organ-on-a-chip

Tissue engineering addresses several important technological needs by providing reliable, true-to-life artificial models that can reduce or even replace animal testing in pharmaceutical and biomedical research. Organs acquire their function through complex 3D organisation of billions of cells. A major problem with current bioengineered tissues is the absence of a vascular system. Oxygen and nutrients only passively diffuse to a maximum distance of 200µm from a blood vessel in biological tissues. Therefore, developing any viable bioengineered tissue/organ that is thicker than 0.5mm requires the construction of a perfused micro-vascular network dense enough to supply blood to every area of the construct.

Scientists have tried to create artificial blood vessels by 3D-printing, or by extruding in a hydrogel matrix (e.g. gelatin or collagen gels). While these approaches allow for the formation of larger vessels, technical limitations don't yet allow for construction of microvasculature (networks constituted of capillary-like vessels whose diameter is <100µm).

In this project we aim to combine vasculogenesis (vascular cells self-organising into micro-vessels) and organ-on-a-chip perfusion technology to develop a viable and functional micro-vascular network. Different vascular cell lines (endothelial cells, fibroblasts and smooth muscle cells, which all have a precise role in the formation of blood vessels) will be co-cultured in a 3D hydrogel to form a micro-vascular network. Once grown, it will be connected to and perfused by biomimetic flow, to mimic the effects of a blood flow and study its effects on the self-assembled vessels.

This vascular network can then be used as a seeding platform for somatic cells (e.g. livers cells (hepatocytes)), allowing formation of vascularised functional organ unit. This will set a foundation for the development of more complex organs and systems when coupled with bigger blood vessels.

The use of 3D printed vessel-like microchannels for the controlled investigation of microbubble behaviour for therapeutic ultrasound research

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Key words: Microbubbles, Ultrasound, 3D printing, Hydrogel, Flow phantom

Microbubbles are tiny bubbles of gas that have an expanding range of medical applications when combined with ultrasound. They are regularly used to improve the quality of ultrasound images, allowing clinicians to more easily diagnose patients without the hazards or expense associated with other medical imaging methods. Another potential use of microbubbles is as a sophisticated drug delivery tool which can better target drugs where they are needed and enhance their action, all while reducing unwanted exposure to healthy tissue. To make this a future reality that can benefit patients, a strong understanding of the behaviour of microbubbles within the body is essential as it is the microbubbles' behaviour in the ultrasound field that makes this aim a possibility. Small drugs and even genes can be attached to the microbubbles before being injected into the blood stream. Once in the desired area, the ultrasound settings can be changed to make the bubbles burst and release the drug. Even when no drug is present within the microbubbles, their oscillations in response to ultrasound can cause nearby cells to absorb more medication than they would otherwise. Not only that, but it appears that there are several mechanisms for how drug delivery is increased. These range from the bubbles tearing temporary holes in the cell to allow the drug to enter, to the cell upregulating its own day-to-day processes in response to movement detected at its boundary.

It is hopefully clear that the benefits of moving this area of research from the laboratory to a healthcare setting are sizeable and plentiful. Unfortunately, there is still a lot that researchers do not yet know or understand about ultrasound and microbubble mediated drug targeting and drug delivery. One of these is the behaviour of microbubbles within the body in real time, which would be extremely useful (if not essential) to know in order to monitor treatment.

My research aims to investigate if the signals scattered by microbubbles travelling through small channels can be reliably used to determine microbubble activity and, therefore, the likely therapeutic effects in a real blood vessel. To do this, 3D-printed microchannels based on real vasculature will be printed using tissue mimicking materials. Distinct factors can then be investigated including flow rate, microbubble concentration, channel geometry and a range of ultrasound parameters. It is hoped that this research will help us to answer several questions including: Have the bubbles burst? Are they near the channel boundary? Are they oscillating in a way that has been shown to improve drug delivery in laboratory experiments?

To produce these tissue-mimicking microchannels, the 3D printable hydrogel resin is being continuously optimised to produce higher resolution features using light-

based 3D printing. Preliminary results using cellulose fibres with an internal diameter of 200 µm have shown some of the effects of changing ultrasound parameters, microbubble concentration, fluid medium and flow rate. These include reduced spectral energy of the driving frequency of the signals in blood compared with saline (Fig 1A) and a positive relationship between flow rate and microbubble concentration at higher microbubble concentrations (Fig 1B).

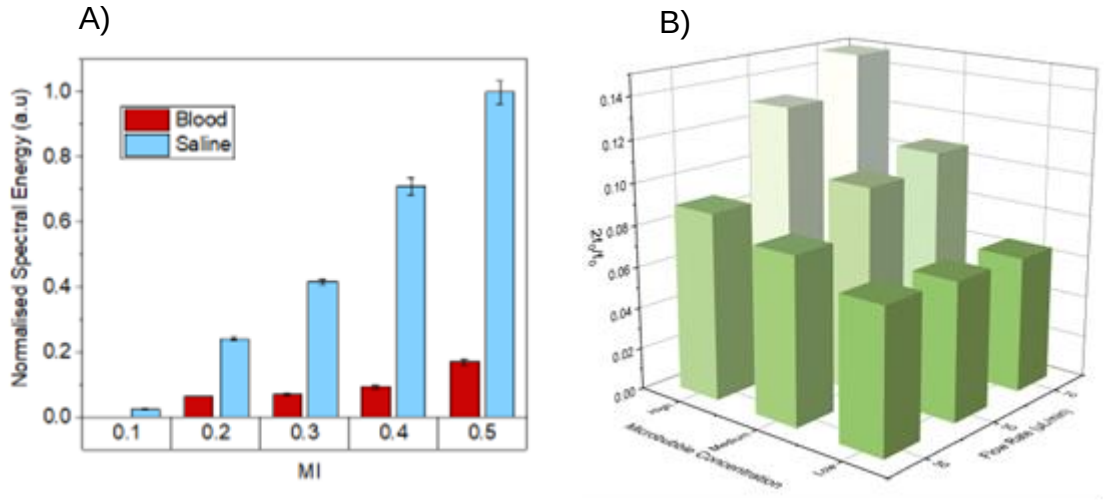

Figure 1. A – The spectral energy of the ultrasound driving frequency (f_0) in blood versus saline at different mechanical indices and a flow rate of 30 µL/min. B – The effect of changing microbubble concentration and flow rate on the ratio of the second harmonic frequency (2 f_0) to the fundamental driving frequency (f_0) amplitude in saline media.

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Assessing the feasibility of using an online monitored Graded Repetitive Arm Supplementary Programme (GRASP) for home-based chronic stroke survivors

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Key words: Stroke, telerehabilitation, arm, exercise, GRASP;(Graded Repetitive Arm Supplementary Programme)

Objectives: Stroke is a leading cause of long-term disability and approximately 75% of stroke survivors experience weakness and loss of range of movement in their affected arm and hand. This impairs their independence, and ability to perform activities of daily living (ADL). As the NHS services are overstretched, they are unable to provide the required long-term treatment to maximize upper limb movement, meaning that for most stroke survivors home based rehabilitation is the only option. There is a desperate need to provide chronic stroke survivors with affordable, home-based rehabilitation programmes that require minimal assistance to improve their upper limb function and prevent learned non-use. One such self-administered rehabilitation intervention is the Graded Repetitive Arm Supplementary Programme (GRASP), designed to target upper limb function with intensive exercise and encourage the use of the affected limb in ADL. GRASP was initially designed as a manual based intervention to be used as a supplemental inpatient programme in hospital, thereby not requiring the constant supervision of physio- and occupational therapists. Several recent feasibility studies indicate that GRASP can also be used with chronic stroke survivors in the home and community environment.

Methods: A mixed method, repeated measures, feasibility study will be conducted to determine whether a home-based arm rehabilitation programme for chronic stroke survivors can successfully be implemented and monitored online over an 8-week duration. The aims will be to determine: 1) recruitment and retention rates of home dwelling chronic stroke survivors to Online-GRASP over a mixed geographical dispersion, in rural and city areas throughout Scotland; 2) whether participants can adhere to the 8-week programme; 3) whether there is a need to modify inclusion and exclusion criteria; 4) barriers to recruitment/ adherence; 5) the types of behavioural strategies needed to encourage arm use; 6) the acceptability and efficacy of the programme; 7) whether the primary and secondary outcomes measures are appropriate; 8) whether it is possible to collect biomechanical measurements outside of a university laboratory; 8) whether existing resources require modification or if additional resources should be developed to roll out a larger RCT in the future; 9) the type of management required for the success of the programme and 10) the identification of barriers to wider implementation.

Participants will be recruited over a 10-month period and screened for suitability. Initial assessments and demonstration of equipment and exercises will

occur over 2 sessions in the home of the participant with the instructor. A Supporter's Manual for GRASP has been devised to provide the family member or carer with additional information. The participant will be given a box of equipment, the existing Home GRASP instruction manual and record sheets. They will receive an online monitoring session once a week with the instructor to discuss progress, determine time spent exercising, the adaption of exercises and establishment of weekly goals. Primary outcome measures will be recorded at 3 successive time intervals: (baseline; post intervention at 8 weeks; and 3 months post intervention for: Arm function (ARAT) and gross dexterity (Box and Block Test). ActivPAL® motion sensors will be attached to the affected and unaffected arm at the wrist and worn over a period of 4 successive days. The percentage of total arm use will be calculated as a ratio of the affected arm to the unaffected arm at each time interval. Secondary outcomes include the Stroke Self Efficacy Questionnaire, Stroke Quality of Life and Brief-Cope as well as a post - intervention qualitative exit interview at the end of the 8 weeks and a questionnaire evaluating the role of the instructor. Recruitment is ongoing; hence no results are reported yet.

Implications: If GRASP is an effective, cost efficient and easily self-directed home-based arm rehabilitation intervention for chronic stroke survivors, which can be monitored remotely online, the programme can be adopted as an additional therapy to existing support services. This has the potential to impact thousands of stroke survivors experiencing upper limb disability. Telerehabilitation in the home allows for greater geographical reach, reduces the burden on allied health professionals, integrates supporters and family members in the process and could successfully be implemented by stroke charity organisations, using the support of volunteers or peer stroke survivors as instructors.

Strain Rate Effect in Ultrasonic Fatigue Testing of Structural Steels

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Key words: structural steel, materials engineering, fatigue, VHCF, experimental

The most common cause of failure in industrial components is known as “fatigue”. Fatigue is characterised by a slow build-up of microscopic incremental damage over many loading cycles, which eventually lead to failure over long periods of time. As such, knowing the number of load cycles a material can withstand before failure is incredibly important when designing industrial components. In recent decades, it has become necessary to ensure the lifetime of components reaches billions of cycles. Traditional fatigue testing methods can only run at 20 load cycles per second (20Hz), however, and so reaching 1 billion cycles would take over a year to test a single sample.

Recently a new technology has been developed, known as Ultrasonic Fatigue Testing (UFT), which employs resonance at ultrasonic frequencies to achieve 20,000 load cycles per second (20kHz). This means that fatigue tests can be run 1000x faster than traditional methods, allowing a sample to be tested to 1 billion cycles in only 6 days. The University of Strathclyde has recently acquired one of these UFT machines: the Shimadzu USF-2000A. It is one of only a few in the country, thereby positioning Strathclyde at the forefront of advanced fatigue testing in the UK.

UFT still has many challenges to overcome, however. One significant challenge is the “strain rate effect”. Essentially, the loads in UFT testing are applied at a much higher rate than in traditional fatigue testing, which can actually cause certain materials to behave differently and appear stronger than at standard frequencies. This phenomenon is especially severe in structural steels, and as such the use of UFT has been limited for this important material.

The aim of this investigation is therefore to investigate the influence of strain rate on the material properties of structural steels and thus quantify the corresponding effect on the fatigue behaviour.

To achieve this, fatigue specimens were manufactured from three different grades of structural steel and tested at frequencies of 20 Hz, 200 Hz and 20 kHz. After testing, the difference between the fatigue data at the different frequencies were compared for each steel, to determine the influence of the strain rate in each material. In all cases, a significant strain rate effect was observed, with the fatigue limit appearing to be ~1.5x higher when using UFT. This agrees well with the results for similar steels in literature.

Additionally, the stress-strain behaviour of the steels is planned to be evaluated at a wide range of strain rates using a Split-Hopkinson Pressure Bar system. This will be used to produce a relationship between the strain rate and important material

properties, such as yield strength. The fatigue data at the different test frequencies will then be normalised relative to the material properties at their corresponding strain rate. This will potentially provide a method through which UFT data can be directly compared to standard fatigue data, thereby allowing it to be used for practical design applications.

Environmental fluctuation, phytoplankton diversity and productivity in the oceans

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Keywords: Biodiversity and Ecosystem function, functional traits, phytoplankton, biodiversity loss, primary productivity

Rapid biodiversity loss poses a threat to ecosystem functioning and its ability to provide goods and services. This is particularly true for system productivity, with the potential to rival even the effects of global environmental changes such as elevated CO_2, drought and nitrogen deposition. Diversity-productivity relationships have been the focus of biodiversity and ecosystem function (BEF) research for almost three decades. BEF theory states that these relationships are mainly shaped by the presence of dominant species with favorable traits ("selection effect") or by a diverse number of resource acquisition and utilization strategies ("complementarity effect"). These mechanisms can affect the strength and direction of the productivity of a system and their effects are generally supported by both experimental and theoretical studies in terrestrial ecosystems. In pelagic marine environments, information regarding diversity-productivity relationships is still limited. Marine phytoplankton comprises a diverse as well as abundant component of our oceans, accounting for almost half the net primary production on Earth. The high diversity of phytoplankton communities hinders detailed assessments, so the overall effect on productivity remains poorly understood. On top of that, time and spatial scale together with environmental disturbances may play a bigger role in dictating the trade-offs between diversity and productivity than previously expected. As such, our ability to model and understand the world's oceans as a carbon sink under changing environmental conditions is reduced. This leads to the emergence of studies with a focus on functional traits, that is, attributes that can influence how a species responds to its environment. The links between phytoplankton diversity, environmental parameters, and productivity pose a challenge on BEF studies, and functional traits are the key to help us disentangle the processes mediating the complex diversity-productivity link. Structural Equation Models (SEMs) are a great tool for analyzing multivariate hypotheses, coupling direct (i.e. abiotic stress filters the species pool reducing richness) and indirect (i.e. abiotic stress inhibits growth reducing biomass and, eventually richness via competitive exclusion) mechanisms. Consequently, SEMs provides us with a framework to interpret ecosystem function links with substantially higher explanatory power than classic univariate analyses. Our project will employ such a multivariate approach to assess how phytoplankton trait diversity (i.e. size) affects productivity while accounting for underlying mechanisms, and how this varies in both observational and modelled data. By analyzing a large data set (>25 years) that comprises records of both environmental and biological parameters, we aim to determine the general effects of phytoplankton trait diversity on productivity and how big those effects are across spatial and temporal scales in determining BEF relationships. As such, our results will

provide crucial information on the functional changes of natural phytoplankton communities under anthropogenic pressure, accounting for community composition and abiotic factors and drive the next generation of BEF studies.

Improving detection and assessment of dementia in the autistic population

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Key words: Autism, Dementia, Assessment, Cognition

The topic of autism, ageing and age-related diseases such as dementia is one which has recently been highlighted as a priority[1]. A literature review highlights that, within this topic, there is almost no research focusing on the impacts of dementia on autistic people, or on the impact of autism on dementia. The scarce and scattered literature reveals challenges such as overlapped cognitive profiles of autism and dementia. This could mean that dementia might be missed in an autistic person. Or, that somebody might be wrongly diagnosed with dementia, when in fact, they are autistic. The lack of any data in relation to autism and dementia needs to be addressed.

This research project, which is in year one of a six year PhD project, seeks to identify the magnitude of the problem in a Scottish context and improve detection of dementia amongst the autistic population, which is a currently neglected area. The research aim is threefold: (1) characterise the problem by identifying prevalence rates of dementia amongst the autistic population in Scotland, (2) identify the risk factors of dementia amongst autistic people and current detection methods and (3) formulate a potential customised dementia assessment package for this population.

In this presentation, I will give an overview of the initial stages of this research including the tools being used to develop a cognitive profile of autistic ageing compared to autistic ageing with dementia. Consideration will be being given to the variability in cognitive functions seen across the autistic population such as executive functioning, memory, and sensory processing. We aim to disentangle cognitive trajectories in autism and autism plus dementia. I will discuss our new theory-driven methodological framework which will tackle a problem that, as yet, has had no real scientific exploration. Developing a customised dementia assessment package for autistic people could have a significant impact on the lives of older autistic people as it could lead to improved services, support, understanding and, ultimately, a better quality of life.

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The effect of prosthesis-related loading on soft tissue health

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Key words: prosthetics, soft tissue, skeletal muscle, cell damage, mechanical loading

Worldwide, one individual loses a limb every 30 seconds because of complications of diabetes [1]. Considering our aging population, this is expected to worsen over the decades to come [2]. To mitigate the negative impact of an amputation on the individual, restoring mobility is key. Often a prosthesis is fitted that replaces the lost limb. One of its most important parts is the socket, which forms the direct connection between the prosthesis and the leg. However, designing and fitting a good prosthetic socket is a considerable challenge: Most amputees report discomfort and pain when using their prosthesis, which often leads to reduced functionality and low acceptance rates. A major reason is our limited understanding of how compressing soft tissues like muscle between the rigid socket and the bone affects soft tissue health. Whilst researchers have explored how prolonged, static loading, for example when standing with a prosthesis, impacts on soft tissue health [3], dynamic loading scenarios like walking and running, have been neglected [4]. We therefore aim to compare the effect of static and dynamic loading representative of prosthetic use on muscle tissue.

We developed an *ex vivo* experiment that uses two different muscles from the hindlimb of Sprague Dawley rats (extensor digitorum longus and soleus). The muscles were dissected and compressed with a pressure of 100kPa for 1 hour either statically, representing standing and sitting, or dynamically, representing walking and running (frequencies of 1.42Hz and 4Hz). Subsequently, the tissues were stained with Procion Yellow MX4R (ProY) for 1 hour before being processed for microscopy. ProY is a fluorescent stain that enters cells that have lost their membrane integrity. Accordingly, we could detect mechanically damaged cells under the microscope (Leica SP8 system). The number of dead cells was counted across five samples for each experimental group in a semi-automated process with ImageJ software. The results were tested for statistically significant differences ($p \leq 0.05$) with Mann-Whittney-tests.

Both dynamic loading scenarios induced more cellular damage than static loading (median number of dead cells: 79.5 (static), 90 (1.42Hz), 135.5 (4Hz)). However, results were only statistically significant between the static and 4Hz ($p=0.011$), and the 1.42Hz and 4Hz group ($p=0.044$). Interpreting these results in a clinical context, sitting, standing, and walking seem to bare a similar risk of damage for the muscle tissue in the residual limb. Fast walking or running however is potentially more harmful to the tissues, which could result in pain and tissue damage. To avoid these issues, adjusting socket fit to minimise soft tissue deformation is crucial. Additionally, identifying threshold levels for damage-inducing loading levels related to the activity performed by an amputee would be helpful. This information can not only inform clinical guidelines on prosthetic socket fit and use, but also be integrated into

home-monitoring systems to allow for patient-specific risk assessment beyond the hospital.

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3-dimensional imaging of nanoparticles through tissue using surface enhanced spatially offset Raman spectroscopy

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Key words: Imaging, spectroscopy, nanotechnology, diagnostics, healthcare

Raman spectroscopy is an analytical technique, relying on an inelastic scattering process of incident light, that provides highly detailed and specific information about molecules in a sample. In recent years, Raman based techniques have been used extensively in bioanalytical research applications with the ultimate goal of creating platforms for medical diagnostics. However, in its most primitive form, Raman spectroscopy is often limited to biopsy and cellular samples and is unsuitable for *in vivo* disease detection through multiple layers of tissue at depth. Spatially offset Raman spectroscopy (SORS) is a through barrier analysis technique that separates excitation and collection regions on the surface of a multi-layered sample by a distance known as the spatial offset, to increase the spectral contribution of the sample behind the surface. SORS has shown promise in the field of medical diagnostics, particularly in the detection of bone disease, drug delivery monitoring and cancer imaging. Surface enhanced Raman scattering (SERS) is a sensitive technique that can be used to detect target molecules in close proximity to the surface of metal nanoparticles (NPs). Using gold NPs, Raman active molecules can be coupled to target specific biomolecules such as antibodies. NPs modified in this fashion are extremely promising for biological applications because they combine specific and sensitive optical detection via Raman spectroscopy with biological functionality. Surface enhanced spatially offset Raman spectroscopy (SESORS) is a powerful detection and imaging method that has emerged in an attempt to combine the signal enhancements offered by SERS with the subsurface probing offered by SORS. Using SESORS, it is possible to non-invasively retrieve subsurface spectra, and hence images, that originate from highly specific biofunctional SERS active NPs inside obscuring materials such as mammalian tissue. It has a great deal of potential as a diagnostic technique because, in contrast to traditional medical imaging techniques, *in vivo* imaging of biofunctional NPs could allow for the non invasive collection of information such as the malignancy of a tumour or the pathogenic strain in a suspected joint infection, that would otherwise only be accessible by performing invasive procedures.

In this work we address a fundamental question crucial to understanding SESORS imaging and implementing it in a clinical setting for *in vivo* diagnostic purposes in the future, namely can a SESORS image be used to give the physical location of SERS active NPs through tissue? We report the effects of the spatial offset magnitude and geometry in locating NP imaging targets through tissue. Experimental techniques are suggested to allow for the correct interpretation of SESORS images to ascertain the location of NPs in the 2-dimensional x, y-imaging plane at depth. More specifically, we present the effect of ‘linear offset induced drag’ which refers to a spatial distortion in SESORS images caused by the magnitude and direction of the linear

offset and highlight the need for a symmetrical optical geometry during imaging to neutralise this asymmetric effect. Additionally, building on these principles, we introduce the concept of ‘ratiometric SESORS imaging’ for the location of buried targets in 3-dimensions. Together these principles are vital in developing a methodology for the location of SERS active targets in 3-dimensions. We tested the robustness of our approach, which utilises the relationship between the magnitude of the spatial offset, the probed depth and ratiometric analysis of the NP and tissue Raman intensities, to ultimately image and spatially discriminate between two distinct NP targets buried at different depths within a 3-dimensional model for the first time.

Challenging the Breadwinner-Caregiver Dichotomy Embedded in the EU's Parental Leave Arrangements

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Key words: law, feminism, equality, gender roles, parental leave

The European Union (EU) has adopted maternity, paternity, and parental leave legislation, on the one hand, to ensure equal treatment and equal opportunities between women and men in employment and, on the other hand, to facilitate better reconciliation of work and family life and a more gender-balanced sharing of childcare responsibilities. Through Feminist Legal Theory, this research highlights how the EU's *Pregnant Workers Directive*, *Parental Leave Directive,* and *Work-Life Balance Directive,* and their interpretation by the Court of Justice of the EU, perpetuate inequalities between the sexes by reinforcing a traditional gender ideology in which men are family breadwinners and mere 'incidental collaborators' (Castro-García and Pazos-Moran, 2016) in childcare, whereas women only escape their role in primary caregiving to the extent that it can be combined with paid employment. That is, although the EU supports formal equality between men and women at work, it still views women to be responsible for the children and men for providing for the family (Matero, 2021).

This research purports to design a new EU legislative framework of maternity, paternity, and parental leave arrangements that achieves the EU's core objective of sex equality and further overcomes various intersectional inequalities, such as those faced by same-sex parents. It does so by evaluating alternative legal frameworks, such as the Nordic model of parental leave which has frequently been cited as a sort of ideal model for the EU due to its ability to enhance fathers' take-up of parental leave, against a feminist conceptualisation of substantive equality between the sexes. The underlying objective is to induce change in the traditional gender roles associated with the sexual division of labour between parents – namely, to break down the breadwinner-caregiver dichotomy particularly by encouraging fathers' active engagement in childcare. And indeed, the proposed legal framework seeks to reflect the reality that men's attitudes about parenthood have already changed: increasing numbers of young fathers want to take time off work to raise their children, as seen in the 'latte pappas' phenomenon in Sweden, and combining paid work and childcare is viewed as the shared responsibility of both parents as equal partners. The legal framework should support this by, for instance, removing the financial disincentive for fathers to take parental leave that persists under the EU's current legal arrangements.

This research thus relates to the notion of changing people and society by challenging the persistence of and highlighting the gradual changes in the sexual division of labour and traditional gender roles attributed to parents. It contributes to the discipline and research area by grounding analysis of the existing legal framework and proposed reforms in Feminist Legal Theory and by introducing an intersectional aspect

to the research area which is absent in recent legal literature on the issue. The legal framework which the research purports to produce has practical applicability within the EU jurisdiction and could be utilised by policymakers, equality actors, and women's organisations in proposing changes to EU law.

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Metallurgical and mechanical property investigation of novel ceramic to steel dissimilar friction welds for nuclear fusion applications.

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Key words: Friction Welding, Nuclear fusion reactors, Dissimilar materials, Ceramic to metal welding, Low cost.

Ceramics have long been implemented into the nuclear power sector as electrical and thermal insulators in fusion power reactors, primarily in the first wall and blanket regions. A principal ceramic is alumina (aluminium oxide) which is usually the first choice for insulator applications in a fusion reactor because of its high-temperature capabilities and commercial availability. Nuclear fusion is widely regarded to be become the predominant renewable energy source in the future.

The biggest challenge in designing with ceramic materials is to ensure mechanical reliability due to their inherent brittle nature. Furthermore, their strength is controlled by the random grain size distribution. Because of this, the UKAEA (Atomic Energy Authority) approached the Department of Mechanical & Aerospace Engineering to perform a feasibility study in joining ceramics to metals. Implementing such a process into generating new combinations of materials and geometries will aim to be used in nuclear fusion applications, as mentioned earlier.

Rotary friction welding, an established variant of friction welding, was chosen as it can produce a high integrity joint between similar and dissimilar materials. This is a solid-state welding process, meaning that materials do not reach their melting temperature and avoid complications such as porosity. In addition to that, they can maintain most of their original properties, something that does not occur with fusion welding. The 2 workpieces to be welded are positioned in line with each other where one piece rotates and the other is held static. The rotation together with axial loading promotes friction between the two parts thus heat is generated at the faying surfaces. This leads to the softening of the material and flowing over one other starting to create a weld which concludes after a specific time period. The main thee parameters which influence the quality and strength of the weld are rotational speed, friction pressure and friction time.

There is limited literature on the subject of friction welding of dissimilar materials such as ceramics to metals. There has been some progress in the last few years where successful welds between alumina and aluminium alloys have been manufactured. However, this is not the case for welds between steel alloys and ceramics such as alumina or carbides.

In this project the decision to investigate using copper as a transition layer was taken because of its better ductility, higher tensile strength and higher melting temperature compared to aluminium. Additionally, copper has not been investigated

as a transition layer in such environment thus increasing the novelty of this research work even at the early stages of development. The optimal parameters for the process were experimentally determined and the mechanical and microstructural properties were investigated. Tensile and bend testing was conducted as well as microscopy and micro-hardness evaluation. In addition, numerical modelling is undertaken to enhance and validate the experimental results such as residual stress and temperature generation at the weld interface. The production of high integrity welds of dissimilar materials such as ceramics to metals will aid the advancements made in nuclear fusion reactors allowing them to operate at higher temperatures for longer. This will support the transition to alternative energy sources as the energy demands increase in the future and society moves away from fossil fuels.

An investigation of dysarthria's impact on communicative participation in Pakistan's cultural context.

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Keywords: Dysarthria, Communicative participation, Psycho-social impact, QoL, cultural impact

Dysarthria is a collective name for a group of neurological speech disorders that reflect abnormalities in strength, range, steadiness, tone, or accuracy of movements required for the breathing, phonatory, resonatory, articulatory, or prosodic aspects of speech production (Duffy, Joseph R,2013). Speech impairment after acquired dysarthria can contribute to changed communication patterns. This might result in increased barriers to communication which can lead to isolation and decline in psychological well-being and decreased quality of life. (Palmer et al., 2019). Disabilities differ according to culture as different cultures have different perceptions about impairments and/or disabilities. (Rao et al., 2007).

The aim of the proposed research is to explore the impact of acquired dysarthria on communicative participation of people living in Pakistan through a selected sample.

Twenty-six adults diagnosed with acquired dysarthria following stroke, Parkinson's disease, multiple sclerosis, or traumatic brain injury were recruited for this study. There were two phases for data collection. In the first phase, the participants completed four self-reporting questionnaires — Communication Participation Item Bank (CPIB), Dysarthria Impact Profile (DIP), Voice Handicap Index (VHI), and Short Form-36 (SF-36) and in the second phase, they took part in semi-structured interviews. The questionnaires' data were analysed using descriptive statistics, and Pearson correlation, and the data from the interviews were analysed using thematic analysis. The results of both the phases were then further analysed.

The results from the questionnaires showed that all the participants indicated impact of dysarthria. Numerous themes emerged from the interviews which included: Independence vs Interdependence, Psychological issues, Awareness, Medical & Healthcare, Socioeconomic (Affluence & Support), Gender disparity/ Roles, Religion, Traditions and Culture and Attitudes. These interviews provided insight into the lived experiences of people with dysarthria in Pakistan, particularly the impact of cultural, psychological, and social practices on their lives. Several interviews revealed that in Pakistan disability is stigmatized and regarded negatively. In Pakistan, cultural perceptions of gender roles increase the impact of dysarthria, particularly among the female population, most of whom are unable to make independent decisions. Change of roles for men is also viewed negatively in Pakistani culture. Participants also revealed a lack of awareness about their conditions and that of communication disorders in the general population, which further aggravates the impact of dysarthria in this culture.

Researchers have found that cultural factors must be considered when investigating the impact of acquired dysarthria on communicative participation. The study offers valuable insights into cultural perceptions of motor speech disorders and associated disabilities and barriers to communicative participation in Pakistan. These findings will benefit clinicians in Pakistan and those working with immigrant populations to better understand how their patients' psychosocial wellbeing may be affected.

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Understanding Algerian international student mental health experiences in UK (United Kingdom) universities: difficulties of disclosure, help-seeking and coping strategies

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Key words: mental health, self-reliance, stigma, disclosure, religious coping

International students often encounter challenges while studying in the UK, including communication and language barriers, lack of social networks and socio-cultural differences that adversely impact on their mental health. For Algerian international students (AISs) these challenges may be heightened as English is not their first language and the culture of their homeland is substantially different from British culture, yet research has to incorporate their experiences and perspectives.

The current study aimed to explore AISs' 1) understandings of mental health; 2) issues of disclosure for mental health difficulties; and 3) mental health help-seeking and coping strategies. Method: In-depth, audio recorded semi-structured interviews (n = 20) with AISs in UK universities were conducted. An inductive, reflective thematic approach analysis was used

The following themes and associated sub-themes were developed: (1) Algerian cultural influences on mental health understanding (socio-cultural comparisons); (2) the paradox of the family (pressure vs. support); (3) stigma and fear of disclosure; (4) Barriers to formal help-seeking (informal disclosure as first step to seeking help); (5) Communication barriers (resort to mother tongue to disclose); (6) Self-reliance and religious coping.

Recognizing and understanding the challenges faced by AISs in terms of disclosure and mental health help-seeking is essential to reduce barriers to formal help-seeking. Informal disclosure among peers is often the first step to seeking help. Enhancing practitioners' cultural competences and awareness of diverse understandings of mental health and the role of religious coping among AISs' may have transferable benefits to a wider international student population

Inclusive Education in Ghana: Understanding inclusive pedagogical practice of primary school teachers in the general education classrooms.

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Key words: Inclusive education, Inclusive pedagogy, Teachers, Regular classroom, learners with special needs

There has been growing concerns about finding more efficient ways of making education non-discriminatory and inclusive for all learners. Various engagements have been done globally, to ensure that educational delivery at all levels is met with equity, social justice and equal opportunities for all learners, including children with special needs. This calls for the adoption of a more flexible, learner-centred pedagogies that accommodate diversity in the learning environment. The role of classroom teachers in supporting all learners, including individuals with special needs, is considered critical. Adopting inclusive approach to learning means embracing change and adapting pedagogies in ways that promote multiple means of engagement, representation and action and expression in classrooms. Ghana as a country has made strides in the areas of inclusive education policy enactment, piloting and continuous implementation of this system. However, reports and research have indicated significant differences between learning outcomes of children with special needs and their typically growing peers. This has raised concerns about teachers' skills and the nature of their inclusive pedagogy. Although there exist several studies on inclusive education in Ghana, knowledge about what teachers actually do in class and why they do what they do is lacking. The purpose of this study is to explore the nature of inclusive pedagogical practices teaches enact in mainstream classrooms in Ghana and the rationale behind those practices. This research seeks to examine how teachers adapt their pedagogies to cater for the different learning needs in their classrooms. Like inclusive education, inclusive pedagogy lacks a defined definition. However, in this study, pedagogy is used to include what happens mainly during the teaching and learning process. Inclusive pedagogical practice therefore, refers to what teachers do during teaching and learning, to support all learners including learners with special needs (LWSNs).

The instrumental case study approach was employed to generate qualitative data on the inclusive pedagogical practices of primary teachers in mainstream schools in Ghana. The semi-structured non-participant observation and semi-structured interview methods were used to collect data from 10 regular classroom teachers. Additionally, 5 resource teachers were interviewed and teachers' lesson plans and teaching artifacts were collected. The Socio-cultural theory of Vygotsky served as the theoretical basis for this research. Additionally, the Universal Design for Learning (by CAST) and the Inclusive Pedagogical Approach by Florian and Sprat were used to support data collection and analysis. Data collected will be analysed through the Thematic analysis approach. Each case will be firstly, treated individually and pulled together to gain a clear and broader view of what is being done in classrooms.

The data collected reveals that increasingly, teachers are considering learners with special needs as members of their classes, who have equal rights to learning as their typically growing peers. Teachers are making efforts to adopt various approaches to include learners with special needs (LWSNs) although these strategies do not differ significantly by subjects. Questions and answers are predominantly used in lessons, with group work, role play and demonstrations rarely used. Teachers employ peer support measures to help LWSNs. Also, teachers make use of one-on-one support for LWSNs. This is done mainly after lessons. LWSNs are generally not considered at the planning stage of lessons; adjustments are made, during teaching, to accommodate them. presentation of information is mainly through vision and audio. This means that children with low vision and the blind are left behind. Teachers rely on textbooks as teaching, learning materials. Some do not use them at all, with others blaming this on lack of resources or the skills to design them. LWSNs seem invisible during teaching as they are mostly isolated in class. Collaboration between classroom teachers and other professionals is minimal and, in some cases, non-existent. In addition to the above, data reveals that teachers are involved in some unexplained practices. The findings of this study will help appreciate how diversity is catered for in regular classrooms in Ghana. Also, this study will provide a clear view of how practice differs from policy demands.

Technology-enhanced Microteaching to Reduce Foreign Language Anxiety: A Socio-cultural Perspective

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Key words: English as a Foreign language, Foreign Language Anxiety, Learning Management System, Socio-Cultural Theory, Microteaching, Technology integration in language learning, Foreign Language Classroom Anxiety Scale.

This study aims to investigate the question of whether implementing a fundamental change in the English as a Foreign Language (EFL) classroom through a specific use of technology-enhanced microteaching will reduce female of EFL learners' Foreign Language Anxiety (FLA). The study will also focus on the variables caused by socio-cultural factors, suggesting that they may have a valuable impact on the level of FLA. Therefore, it was suggested that the implementation of Socio-Cultural Theory (SCT) by Vygovtsky is suitable and might reveal interesting findings. Instead of the previous attempts at decreasing anxiety and improving performance, this study will advocate implementing an intervention of technology integration through the use of Learning Management Systems (LMS), the foundation for which is already available, and activated after the remote teaching during the pandemic of COVID19. Microsoft Teams was used as a virtual learning environment for attending courses and social networking at Kuwait University. It was also a great prospect for a future study. In an English course from the English Language Unit (ELU), students are usually asked to give an in-class presentation, and due to the pandemic, this assessment was switched into a three minutes of video (previously recorded) presentation, followed with the teacher's feedback and grade submission. Strengthening the importance of and curiosity in this research is the fact that the remote teaching assessment acted as a pilot study to see the effectiveness of technology integration in reducing FLA. Therefore, the involvement of socio-cultural theory is suggested to prepare the current study for a deeper investigation. The mixed methods approach is the suggested methodology for this study where pre and post Foreign Language Classroom Anxiety Scale (FLCAS) surveys and semi-structured interviews are going to be applied on two groups (controlled/experimental). Based on the previous studies, and the fact that the current study at its preliminary stages, technology integration from a distinct perspective is worth implementing for its effectiveness in the field of education.

Getting a kick out of life: controlling the fate of cells with 'nano-kicks'

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Key words: Stem cells, vibration, nanokicking, mechanotransduction

In recent years, mesenchymal stem cells (MSCs) have found widespread use in tissue engineering, offering a potential source of treatment for many diseases including bone diseases. One of the most prevalent bone diseases is osteoporosis, which results in significant loss of bone density, and primarily affects women, with 1 in 3 over 50 suffering from osteoporotic-related fractures [1]. However, understanding how MSCs differentiate into specific cell types and controlling this for clinical use is particularly challenging. In addition, scaling up cell engineering technologies to produce enough stem cells for clinical implantation remains a major limitation.

Mechanical stimulation, i.e. application of force to cells, is one way to potentially increase cell proliferation and direct stem cell differentiation [2]. When adhering to a surface, cells experience nanometre ripples on their surface, suggesting that cells may sense their environment at this scale [3]. In an attempt to interfere with this process, the Universities of Strathclyde and Glasgow have developed a novel cell stimulation technique termed 'nanokicking', which uses nano-amplitude vibration to mechanically stimulate cells *in vitro*. A device capable of producing these vibrations has been developed at Strathclyde, applying vertical vibration to cells at a single frequency of 1 kHz and amplitude of 30 nm [4]. Using this device, nanovibrational stimulation has previously been applied to MSCs, successfully directing the cells toward bone cell formation (osteogenesis) [5]. However, more recent studies have suggested that cells have an increased response at higher amplitudes (e.g. 90nm) [6]. This demonstrates that the mechanisms by which cells respond to vibration are poorly understood, making it difficult to precisely determine optimal vibration conditions.

This project aims to investigate a range of vibration conditions applied to cells in an attempt to understand how cells respond to vibration. Initial *in vitro* studies have used mouse fibroblastic cells, a cell line involved in producing, maintaining and repairing connective tissue throughout the body, and which experience mechanical forces regularly. Nanovibrational stimulation at 1 kHz and 30nm has led to an increase in cell number, nuclear area and nuclear stiffness. Cell stiffness has been found to be dependent upon the duration of stimulation, with the highest response occurring within the first 24 hours. Work is ongoing to further explore the effects of different frequencies and amplitudes on cell response. The direction of vibration is also being studied, to determine whether vibrating cells parallel to the cell monolayer (horizontally), produces increased cell response compared to perpendicular (vertical) vibrations. Computational modelling of cells suggests that greater stresses can be achieved on

both the cell and nuclear membrane via horizontal vibration. A device capable of producing horizontal vibrations is currently being designed.

By understanding further the effect vibration has on cell response, more precise vibration conditions may be determined. This will make it possible to optimize directing stem cells toward bone formation. The project also aims to investigate if nanovibration can direct stem cells toward the formation of cartilage or neural-like cells. This work is providing further understanding into the effects of vibration on stem cells and how nanokicking can be used to direct stem cell fate for use in stem cell therapies.

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Are future teachers aware of the iceberg of their students' perceptions?

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Key words: Student teachers, Phenomenological research, Perception, Science Education, Changing people, Chemistry, Narrative

The ways in which general science has been taught and learned in the last fifty years has been heavily influenced by pupils' perceptions, according to Devlin and Bokulich (2015). There are many misconceptions and similar experiences among pupils that have contributed to damaging misunderstandings of scientific concepts, specifically those in chemistry. According to early educators, children's minds are open to new ideas and do not contain naive theories or beliefs and that pupils are largely blank slates (McLean et al., 2001). Tippett (2010) states that misconceptions are unavoidable and essential to the process of learning, and educators should ignore misconceptions and think about subject content from a new perspective. As early as the 1980s, educators such as Driver et al. (1986), Pines and West (1986), began recognizing that the constructive view of learning science served as a theoretical framework for misconception research. Based on their systematic review of the literature, Modell et al. (2005) defined a misconception as an incorrect perception of reality, which is in contrast to the scientific explanation of reality.

This situation can be visualized by considering our perceptions today as our misperceptions tomorrow. The misconception that Coronavirus 19 will end with herd immunity, so vaccinations aren't needed is a perfect example of how misconceptions are formed. Therefore, perceptions and preconceptions should be distinguished from a lack of understanding and should be viewed as alternative perspectives. In addition, by observing how pupils formulate their preconceptions and the context in which they do so, academics see the differences between misconceptions and preconceptions. English Science Curriculum was introduced into primary and secondary schools in 1988 under the Education Reform Act. Two world wars during the 20th century led to structural change in England, which influenced how education about science was delivered to the general population. The science field is still struggling to find qualified teachers and students who are interested in science 100 years on. Advanced technology raises more obstacles to success. In this study, the research approach is qualitative, using narrative research designs and phenomenological methods. An analysis of the relationships between textbooks, teachers, the media, the environment, etc. was necessary. Research uses triangulation because it offers novel perspectives on research goals.

Variables are inherent to every research project, and sometimes they are the limiting factor in gathering or analyzing data. Qualitative research focuses more on depth of knowledge than quantity. As this research focuses on student teachers, particularly those training for chemistry science qualifications, it was limited by the

cohort and sample size, as well as the area of study. This may have impacted the results of the study in determining student teachers' understanding of misconceptions about chemistry among GCSE pupils in England. The misperceptions of students differ by catchment area due to linguistic differences; in England, it most likely stems from dialects and English as a second language. Change People has always placed a strong emphasis on education for all. An essential component of "A Changing World" is education for all. This research fits well with the theme of a changing world and changing people like the student's teachers' understanding of the iceberg of misconceptions involved in GCSE science education.

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Development of a Low-Cost Portable IMU System for In-Shoe Foot Motion Analysis

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Key words: foot motion, IMU, kinematics, in-shoe, gait analysis

Background: Walking with shoes is common in our daily life. Most foot motion analysis reports are based on barefoot and laboratory experiments. It is difficult to describe foot motion in a shoe or with orthoses especially in clinical settings. A recently developed Inertial Measurement Unit (IMU) foot motion analysis system may solve this limitation to measure 3D motion of the 1st metatarsophalangeal (1st MTP) joint during level, free speed walking with nurse footwear in a corridor.

Aim: To develop an IMU system that can measure foot motion inside a shoe.

Methods: The system consists of 9-axis IMU, TinyZero microprocessor board, Wifi TinyShield board and microSD TinyShield board. Each prototype is installed inside a 3D-printed box and is powered up by a 3.7v 400 mAh Lithium-Ion Polymer Batteries. Each IMU is connected to the package through a 20cm long wireling. One hand switch is used to control start and stop of sampling data. Foot switches placed under heel and toe of each foot to detect heel strike and toe off. Each IMU is put on the first metatarsal and proximal phalanx respectively on both feet. The subject wore the system with nurse footwear first stood for 3 seconds then walked in the corridor at self-selected pace at least three trials. The data were exported to Excel for Windows where all further data processing and analysis were carried out. Joint coordinate systems were used to calculate the joint rotations in all three anatomical planes

Results: Consistent joint rotations exhibited within cycles. Dorsiflexion started to rise at heel off and got to peak values (about 40^0) at 50% of gait cycle then dropped to 0. A second small peak showed at late swing phase. At the end of stance phase, adduction peak occurred (20^0) Peak internal rotation showed firstly at toe off (about 7^0) then at 90% of gait cycle in late swing phase (about 10^0).

Significance: This system is low cost, simple and portable. It can measure foot motion inside a shoe in the real world. It is easy to use, has no limitation to space, and can provide 1st MTP joint motion in the nurse footwear. Repeatability, validity and accuracy study needs to be done for clinical use in the future.

Designing a green continuous crystallisation process for caffeine crystals using water as the solvent

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Key words: Continuous crystallisation, Crystallisation design modelling, Caffeine crystallisation, Green industry, Future manufacturing

Crystallisation is a technique commonly used for purification purposes. However, the method is solvent extensive and often uses organic solvents, potentially hazardous to the environment. Hence, crystallisation is currently undergoing changes to meet regulatory and sustainability requirements in response to the climate change crisis. Popular approaches to meet these demands include changing how crystallisations are performed (batch vs continuous) and adopting green, eco-friendly chemicals. In the food industry, particularly in coffee production, the coffee husk is known to contain caffeine despite being a residual product. By applying the green crystallisation method in the extracted coffee husks, obtaining caffeine would provide additional value and reduce industrial waste.

The objective of this work was to develop a simplistic design of a continuous cooling crystallisation of caffeine using water as a non-hazardous chemical solvent to produce a well-defined product. The output of this work would be the predictive process parameters of the crystallisation process and crystal's specification: crystal size distribution (CSD) and crystal form.

A population balance modelling (PBM) approach was used to estimate the process parameters to achieve a productivity of 100g/L.hr of crystals. In this calculation, some assumptions were taken: (1) there were no crystal generation, only crystal growth; (2) crystal structure was known and constant during the process; and (3) the process was in steady-state. Product specification was based on the work of Edwards *et al.* (1997). The crystallisation temperatures were calculated from the caffeine solubility data in water (Shalmashi & Golmohammad, 2010). Crystallisation rate parameters were determined from the work of Brown *et al*. (2018). Finally, crystalliser dimensions were calculated according to the modified Durand equation (Yang et al., 2017).

The final design proposed resulted in a yield of 77.69% and a median particle size of 400 µm in the form of a caffeine hydrate. The calculated crystalliser residence time would be 47.1 min, with dimensions of 15 mm in diameter and 4 m in length.

This work showed a systematic approach for continuous crystallisation process design and a framework for future green-laboratory research design, particularly for the caffeine crystallisation from the coffee husks. Moreover, worldwide coffee production increased by 28% between 2007 and 2017, generating millions of coffee husks as the residual product (Capuci et al., 2020). Therefore, the possibility to provide

additional economic value while still environmental-friendly would pull a great interest in its application.

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Collaboration in Assisted Spelling for Autistic Non-Speakers

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Keywords: Autism, Non-Speaking, Assisted Spelling, Communication, Intersubjectivity

Assisted spelling is a form of augmentative and alternative communication designed to enable non-speakers to communicate. Spellers sit alongside a communication partner and point to items on a letterboard (a board with printed or cut-out letter shapes) to spell their messages. The communication partner provides support to the speller. This support can be physical – the facilitator helps the user by holding their hand or arm to guide their pointing. Alternatively, it may relate to the letterboard – the facilitator will position or move the board to ease the user's pointing. The method has garnered both avid support and fervent criticism across the last four decades, with many investigations focusing on the role of the facilitator and asking the question, "Who is really authoring these messages?" (Biklen, 1993; Schlosser et al., 2014; Hemsley et al., 2018; Jaswal, Wayne & Golino, 2020).

This work will address a different focus, arising from first-hand accounts of spellers and an emerging theme in the recent literature. It has been proposed that assisted spelling is a collaborative process, through which the speller is able to communicate their own ideas with physical and cognitive support from their communication partner (Faure, Legou & Gepner, 2021; Nicoli et al., In prep.). Specifically, this project will investigate the nature and value of collaboration in assisted spelling with an autistic non-speaker. A first phase will see them learn to spell with a new communication partner who will self-report and reflect on their experience after each spelling session. The second phase will look closely at their partnership, using 3D-motion capture technology to pinpoint elements of synchrony in the movements of the speller and communication partner. This will allow for an examination of the reciprocity and attunement we hypothesise is taking place.

The project could have significant implications for the field of autistic communication and begin to change how people think about assisted spelling. Professional bodies, clinicians and researchers criticise the partnership required for assisted spelling. In particular, the potential influence the communication partner can have over the messages produced calls into question its legitimacy as a means of allowing the speller to communicate (Chan & Nankervis, 2015). It may be the case, however, that the need for intervention from another can be re-framed. It is possible that the findings of this research will help to do so, by using motion capture data to highlight the reciprocal nature of the interaction spellers and their communication partners have around the object of shared intention and attention that is the letterboard. The reality may be that some non-speakers require the cognitive and physical support of another to create and express their messages through assisted spelling. If this is more clearly framed and understood, the method may no

longer be criticised but instead utilised to unlock the voices of millions of non-speakers.

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Trial and Error Experimentation? No thank you! A more rational approach to catalyst design.

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Keywords: Artificial Intelligence, Rational Molecule Design, Computational Chemistry, Drug Discovery, Computational Modelling

Medicines, or drugs, are essential to many people's day-to-day lives worldwide. However, new drugs are decreasingly becoming approved for public use, frustrating many developers, and causing huge costs to the companies which develop them. Most drugs fail within clinical trials, at which stage millions of pounds will have already been invested. By catching these failing drugs early, losses can be minimized. One feasible way to achieve this is to study how drugs interact with your body. Does the drug reach its target? Does it reach the target but have effects on other parts of the body too? These are two examples of a series of questions that medicinal chemists ask when developing a drug.

One way to track a drug through the body is to label the molecule with a tag. This is like how animals are tracked in the wild but on a much, much smaller scale. Chemists can achieve this by way of a process named Hydrogen Isotope Exchange (HIE). This involves taking a molecule and effectively swapping an atom of hydrogen with one of its heavier isotopes. Isotopes are forms of the same element that differ in mass but not in properties. These isotopes can then be tracked through your body (Similar to PET scans in hospitals) to determine the answer to some of the chemist's questions. However, HIE requires drug molecules to undergo reactions to facilitate the change of isotopes. One of the more widely used ways of achieving this is using an iridium metal catalyst. Catalysts are materials that allow reactions to proceed more quickly or in conditions not possible without them. These reactions can become very specific and will only work for select molecules. Thus, expanding the scope of HIE reactions is of interest to improve labelling among other areas of research.

Computational chemistry allows us to gain a significant understanding of these reactions in terms of how energies change throughout a reaction and how molecules interact by modelling reactions on a computer. By combining these insights with the power of artificial intelligence (AI) it is hoped that the development of new catalysts, which will improve the scope of HIE labelling, will drastically increase by giving new structures to synthesize without any trial-and-error lab experiments. A combined computational chemistry/AI approach contrasts highly with traditional approaches to catalyst production. An approach which involves lots of trial-and-error type experimentation with a more limited targeted synthesis design. By reducing general experimentation, costs can be reduced, and a framework put in place for producing technology to revitalize the way catalyst production is approached. This further allows for the exploration of new molecules with the potential to affect the world in ways like penicillin and modern medicine.

We report the building of a dataset of several thousand molecules, energies, and coordinates for use in the training of an AI method. Promising preliminary results highlight the need for a wider dataset but show good initial accuracy of the method.

Discovery and Applications of a Novel Solid-state arrangement: Water bridge Salt Form

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Keywords: Salt Hydrates, Water Bridges, Solid-state pharmaceuticals, X-ray diffraction, Disproportionation.

In the pharmaceutical industry, significant efforts have been made in discovering new molecules, selection and control solid forms with higher efficacy and better target binding. The poor aqueous solubility and less bioavailability in most of the newly discovered drug molecules is one of the key challenges for scientists. Different techniques have been used to enhance the solubility such as cosolvents, polymorphs, salts, and surfactants [1]. Salt formation is the most preferred approach to increase the aqueous solubility, and dissolution rate and enhance the bioavailability in the drug development [2].

It has been argued [3] that 50-70% of administrated small drug molecules are in the salt form. However, in many cases when basic excipients are mixed with the salt form of a weakly basic drug, the counterion dissociates from the salt [1]. The tendency of the salt form of API when mixed with acidic or basic excipient to convert back to unionized form in an acid-base reaction under certain conditions is known as disproportionation [1]. The process of disproportionation is undesirable and is a major concern for formulations since it may reduce the bioavailability and dissolution rate of the pharmaceutical product. Different factors like environmental conditions during storage and physicochemical properties of the drug (pHmax, influence the process of salt disproportion). It is of utmost importance to understand the underlying mechanism of disproportion as the formation of the free base in the drug product can cause a decrease in the dissolution rate, stability problem, and bioavailability [1].

Prof Lynne Taylor and Pfizer [1] investigated different salt forms of Miconazole mesylate (anhydrous and hydrate) for disproportionation reaction. It has been found that the rate and extent of salt disproportionation for different solid forms of miconazole mesylate are significantly different and amorphous and anhydrous forms are more susceptible to disproportionation and also undergo phase transformation. However, salt hydrate form showed unexpected solid-state and solution stability and had a unique “water bridge” arrangement. A detailed analysis of the dihydrate structure showed miconazole molecule is connected to mesylate by intermediate water molecules.

The lack of detectable disproportionation reaction and unexpected stability of hydrate form could possibly be explained on the basis of a unique hydrogen bonding network which is shielding the salt bridge and inhibit the proton transfer for disproportionation. Thus, the aim of this project is to build a fundamental

understanding of salt “water bridge” propensity, creation, stability, and physical property relationships with salt hydrate systems. To identify examples of water bridge formation CSD structural search tools, and water packing arrangements in the CSD Database of organic and organometallic crystal structures will be searched. In this we seek to identify opportunities to extend the stability of salts through water bridge salt forms.

Our present study will explore the molecular features that favor water bridge formation in molecular salts, the factors that affect their formation from solution crystallization, and the solubility, dissolution, and stability of selected water bridge hydrate structures. Salt bridge formation on the selected system under a wide range of temperature pH and water activity will be analyzed to investigate hydrate formation under thermodynamic and kinetic control. The aim here is to reproduce samples of water bridge hydrate salts with associated information on related anhydrous and alternative hydration states. All forms will be characterized using single crystal and powder X-ray diffraction to determine crystal structure.

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A Systems Approach to Realise People-Centred Remote Atrial Fibrillation Monitoring

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Key words: remote patient monitoring, atrial fibrillation, wearable technology, healthcare systems approach, digital health

Atrial Fibrillation (AF) is the most common cardiac arrhythmia in the world and a leading cause of stroke. There are over 96,000 cases in Scotland as per the Cross-Party Group on Heart Disease and Stroke's report [1]. The early detection and subsequent management of AF can reduce the risk of stroke and mortality. However, several AF cases are either asymptomatic or manifest as episodes that terminate spontaneously or within 7 days. This limits the use of routine check-ups and other standard methods of diagnosis. Patients need to be monitored continuously and outside of hospitals for an extended period, which is known as remote patient monitoring (RPM). This can be done using wearable and compact devices that record physiological data of the heart. Many of these devices such as smartwatches and Fitbit bands are also commercially available and allow patients to track their data in real-time.

Unfortunately, most RPM programs fail to go beyond the pilot phase and become actual health interventions [2]. This is because most studies have focused solely on technological aspects and have failed to address the broader and more 'people' challenges faced by patients, doctors, and other stakeholders. RPM is burdened by a poor rate of patient adherence, particularly among the elderly who are less tech-savvy. In a study conducted in the United States, around half of the physician respondents said that more than 75% of their cardiac patients enrolled in RPM programs were not connected regularly [3]. Several healthcare projects involving the use of digital technology such as RPM fail in the long run because they are implemented in a top-down and technocratic manner, where technologies are forced upon doctors, nurses, and other health workers without considering their diverse needs and the health systems they constitute. The 2002 National Program for IT (NPfIT), which aimed to digitalize all the National Health Service (NHS) organizations in England, was one such project that had to be abandoned 10 years later and resulted in a loss of £10 billion [4]. Hence, there is a dire need to reimagine RPM and the associated pathways for it to improve patients' quality of life and be clinically acceptable.

This project proposes a 'systems' approach to the design of AF clinical pathways that use RPM. It is a novel and holistic approach that will consider the technological, behavioural, and contextual factors associated with health systems [5]. The project will unfold in 3 stages. Firstly, structured interviews and observation studies involving patients, doctors, and other stakeholders would be conducted to

understand their diverse needs and expectations. Secondly, user experience (UX) approaches involving an understanding of user behaviour would be used to better inform the design of interventions utilizing wearable technology. The third study would combine the findings of the first two studies and a further understanding of health systems to implement a remote AF monitoring intervention. Patient-reported outcomes and scales that assess the clinical acceptability of digital health interventions would be used to evaluate the RPM solution. The results of the proposed study may also help better inform the design of other digital health interventions such as electronic health records, contact tracing applications, etc.

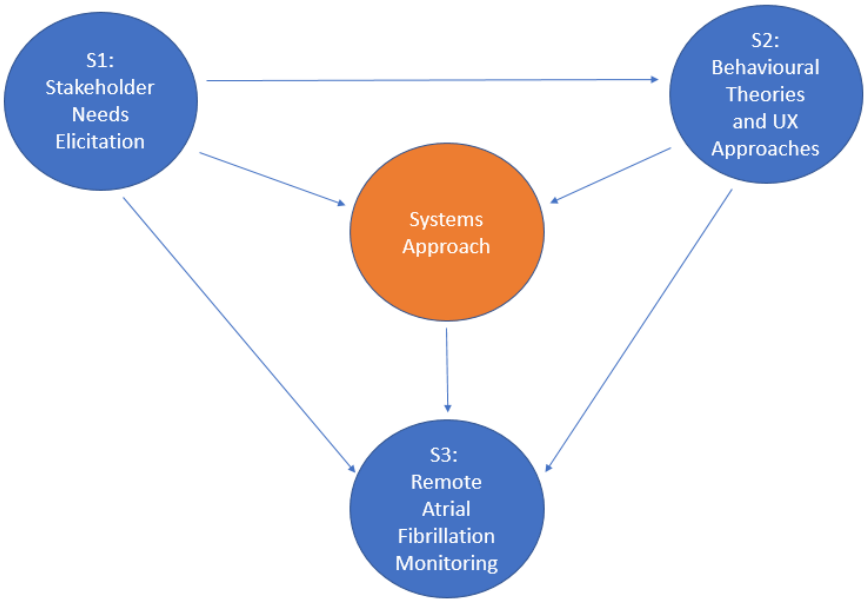

Figure 1 The interrelationships between the 3 studies (S1, S2, S3)

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How is resilience identified, defined, and measured within families impacted by Fetal Alcohol Spectrum Disorders (FASD): A mixed method narrative systematic review.

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Keywords: Resilience, Fetal Alcohol Spectrum Disorder, Family, Lived experiences, Systematic review.

An ESRC funded Supervisor Led Collaborative Project between the University of Strathclyde and the FASD Hub Scotland managed by Adoption UK Scotland.

Background: Fetal Alcohol Spectrum Disorder (FASD) is a lifelong developmental disability arising from prenatal alcohol exposure. Alcohol that passes through the placenta can cause neurological and physical deficits within the foetus that have a lasting impact throughout the life course of the child. Prevalence rates of FASD in the UK is estimated to be between 3% and 5% of the general population, three to five times higher than that of Autism (Scottish Intercollegiate Guidelines, 2019). Children with greater exposure to prenatal alcohol are also more likely to be placed in the care of the state, Gregory et al (2015) reported that 75% of care experienced children had medical histories that include prenatal alcohol exposure. Caring for a child with FASD has a significant impact on the family, disrupting everyday family life and placing increased demands on the family's time, energy, and resources (Petrenko et al., 2019). The parental stress of raising a child with FASD can lead to family breakdown, placement disruption, and low levels of wellbeing (Doak et al., 2019). However, not all families raising a child with FASD experience these difficulties.

Aim: This systematic review aims to understand how and why some families impacted by FASD can be resilient despite still experiencing the challenges associated with caring for a child with disabilities. The following three specific review questions will be explored:

- How is resilience identified, defined, and measured within families affected by FASD? Does this change depending on differing family demographics?
- What are the individual and structural mechanisms or factors associated with gaining resilience in families affected by FASD?
- Do the mechanisms or factors of resilience vary depending on the demographic characteristics of the families?

Methods: Four databases will be systematically searched using relevant keywords, the many articles found will be reduced using a predetermined inclusion/exclusion criterion. Within this mixed-method review, the qualitative data will be synthesised narratively with the use of tabular presentations of the corresponding quantitative data. The tabular presentation will include any effect measures originally

reported where available and the quality appraisal of the qualitative articles will be substituted for measures of effect.

Results: The systematic review is currently underway; therefore, no results are available at the time of writing. Preliminary findings will be included within the presentation. The findings identified will note the repetition of key findings, concepts, and themes found across the multiple papers and designs.

Impact: This review will inform the collection of primary data in the planned interlinked qualitative study and the later quantitative study to build a model of resilience in families affected by FASD. This study is ideally situated to inform both policy and practitioners regarding the long-term impact of both FASD and early childhood trauma whilst providing a model of FASD family resilience that will be a valuable guide to forming interventions and placing vital support structures in place. FASD is the most common yet mostly unknown neurodevelopmental disorder in the UK. The Scottish Intercollegiate Guidelines, 2019 for FASD is just one example of how the Scottish government is now deeming FASD a priority policy area. It's time to change the outcome for families, raise awareness, and reduce the stigma and isolation families are facing.

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A Deep Learning approach to address the challenges of low training data for neural networks applied to ultrasonic NDT

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Key words: Deep learning, Synthetic data, Generative Adversarial Networks, Non-destructive testing, Ultrasonic testing,

Non-destructive testing (NDT) is an important process, which allows manufacturers of aircraft components to confirm that they are free from defects and airworthy. Ultrasonic testing is one of the most widely used NDT techniques as it has excellent detection capabilities and is relatively easy to implement. However, whilst scans can be conducted with robotic systems, the interpretation of the results still requires skilled operators. This is a large bottleneck in the manufacturing process as manual testing is not an easily scalable process. In addition, to being a time intensive process, the requirement of a human operator also introduces human error.

Deep Learning offers a potential solution to this problem. Deep Learning is a subfield of Machine Learning inspired by the human brain which aims to model relationships between features in data. Deep Learning has shown great potential in tackling image recognition tasks, from self-driving cars to medical diagnosis, and could greatly improve both the speed of detection and accuracy of detection in NDT. However, training Deep Learning models requires vast amounts of training data that algorithms can learn from, and this is often unavailable in many situations. Particularly in NDT due to the lack of defective components produced from manufacturing, vast amounts of training data is simply not available to train an NDT detection algorithm on. To help solve this issue, the first stage of my work is focusing on using Generative Adversarial Networks (GANs), combined with physics-based models (Finite Element Analysis) to produce synthetic datasets that accurately mimic experimental data. The approach will use the physics-based models to accurately produce defect responses. However, these simulated responses, whilst physically accurate, are often very far from real-world experimental results due to noise etc. The GAN will therefore map the simulated data to the style of realistic experimental data which more accurately represents the real world. The resulting synthetic datasets can then be used in the training of different networks for various detection and classification tasks.

If this research is successful, it could add a new solution to tackle the challenge of limited data for Deep Learning tasks, by producing simulated datasets from physics-based models. As simulated data could be produced to model any type of defect, and the amount of training data would only be limited by relatively cheap computational costs. This would help to reduce the barrier to entry for powerful Deep Learning tools for many scientific and wider fields.

Factors that affecting on consumer behaviour intention and willingness to pay to choose a green hotel in the United Kingdom

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Keywords: Green hotels, Theory of planned behaviour, Consumer behaviour, Environmental Friendly hotel, Willingness to pay

The United Kingdom is one of the favourite destinations of tourists around the world; the number of tourists who visit this country increases gradually. Nowadays, environmental problems are discussed considerably, and people are starting to be aware of conservation activities. In the hotel industry, green hotel is becoming a new trend that can attract guests who are concerned about the environment and intend to be involved in green practices.

The general objective of this study will investigate the relationship of attitude, subjective norms, perceived behavioural control, and perceived value with behavioural intention and its influence on behaviour and willingness to pay. The target population of this study will be domestic and international tourists, who visited green hotels in the United Kingdom during the survey period. This study will contribute new knowledge on the relationship between TPB and guests' behavioural intention and behaviour toward green hotels. The collected data were statistically will analyse by using SPSS 21 and AMOS 21.

This study will contribute theoretically and practically to the area of behavioural intention and behaviour of green hotel guests who select green hotels during their travel in the UK. This study will extend the literature regarding the effect of the perceived value of guests on their behavioural intention and behaviour toward selecting green hotels in the United Kingdom. The study can benefit hotel marketers, especially those of green hotels, in their understanding of what tourists want and need. The findings of this study will guide the designing of effective marketing strategies to increase consumer behavioural intention as well as to influence current tourists' intention to return and recommend green hotels in the United Kingdom to others.

A conceptual 3D (Dynamic) city model for scenario-based modelling, urban planning and decision making

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Key words: Digital Twins, Built Environment, Data simulation, 3D Cities, Urban Planning

My research focus is on the use of modern and innovative digital tools to enhance urban planning and decision-making. Urban planners often work in complex and ever changing/dynamic built environments (cities) and have to deal with layers of information (buildings, land uses, green and blue spaces, road infrastructure/communication networks, public and private services), making conventional 2D and static maps and plans inefficient planning tools. Rather planners are developing more interest in 3D models and the use of visualization tools in making better informed decisions about the present and future status of their cities.

The research will involve the use of a combination of modelling, simulation, animation and visualization tools and techniques drawn from the AEC (Architecture, Engineering and Construction) industry (notably city information modelling or CIM); the gaming industry (such as the use of gaming engines and computer graphics for data simulation, animation and visualization), as well as the use of geospatial analytic tools to build a prototype of an city interactive city map or city digital twin for the city of Glasgow. City digital twins are not just geometrical representations of cities but also carry rich information of our cities that can be used for simulation and animation. Where the Architectural Engineering Construction and Technology industry is limited in terms of software capability to accommodate the production of interactive information rich city models, gaming engine push the boundaries of what a city digital twins can entail. The flexibility game engines provide and enable the provision of more creative and experimental data layers in city digital twins that can encourage a coordinated planning dialogue amongst planners, policy makers and the public, whilst simplifying a complex planning system.

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 This research will also contribute to the development of a centralized structured data repository, a city digital twin, where city data can be processed and visualized, and can encourage an integrated decision-making approach for government, stakeholders, urban planners and policy makers.

The impact of spirituality and locus of control on self-esteem

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Key words: Spirituality, Self-esteem, Well-being, Beliefs, Psychology

Self-esteem is strongly linked to both emotional and physical well-being, therefore creating a need for research investigating the circumstances which may help to bring about higher levels of self-esteem. Spirituality may have a positive impact on self-esteem (e.g. Stern & Wright, 2018), however, research findings on this relationship have, until now, been mixed. This may be because the relationship between spirituality and self-esteem is being influenced by various other factors.

Locus of control may be one factor which impacts the relationship between spirituality and self-esteem. 'Locus of control' refers to the extent to which people believe their life events and experiences are controlled by themselves (internal locus of control) or by forces outside of themselves (external locus of control). According to Levenson (1972), there are in fact 3 types of locus of control: internal, external – powerful others, and external – chance. Each of these may impact differently on the relationship between spirituality and self-esteem, however, this has not yet been directly investigated. The aims of this study are therefore to examine:

1. Whether there is indeed a relationship between spirituality and self-esteem.

2. Whether and how each type of locus of control impacts on the relationship between spirituality and self-esteem.

A series of online questionnaires is being conducted to meet the aims of this study. Additionally, researchers in the field of spirituality have traditionally defined spirituality as a religious construct, focusing on religious people and/or measuring spirituality using religiosity questionnaires. This study therefore aims to specifically examine spirituality by using a spirituality questionnaire that is non-religious and is intended to be more universal and inclusive of a wide range of expressions of spirituality (Elkins et al., 1988).

The findings of this study may have implications for the public health sector, especially as spirituality and spiritual health are often overlooked in health care. An understanding of the impact of spirituality on self-esteem is important for the development of mental health interventions that take an inclusive approach towards spiritual health. In the current social climate where there is a growing interest in how people's spiritual lives were impacted during the height of the Covid-19 pandemic and subsequent lockdowns (e.g., Kala, 2021), studies such as this may provide some insights on how we can better understand the role of spirituality in well-being in the post-pandemic growth era.

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The future of technology regulation: assessing whether the WTO forum can address the increasing anti-competitive nature of the big tech four with a consideration of a new global governance structure.

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Key words: Global Technology Regulation, International Trade Law, Competition Policy, Date flows, Big Tech Four

The technology sector is dominated by four global giants - Google, Apple, Facebook, and Amazon (The Big Tech Four) - all of which hold enormous control over our digital lives. Each one has contributed to the development of the online world and in making consumers' lives easier. Equally, however, these Four now dominate their respective markets and have significant influence over the digital economy. Each has been allowed to grow to unprecedented levels, and the current regulatory regime is not capable of containing them. Currently, this is governed by regional competition law, with each State applying its own laws to remedy abuses to the consumer, but as it currently stands, the issues are so complex and cover several jurisdictions that it is proving difficult to contain Big Tech. This has led to much of the international community calling for an international solution and an adequate forum has been suggested through the World Trade Organisation (WTO). The research firstly examines the linkage between competition policy and trade law, providing evidence that historic attempts to combine the disciplines has failed. Having said this, the WTO's decision in the recent Mexico/Telecoms dispute provides evidence that such a link can be proven and effective where specific industries are targeted. In this case, successful competition policy was agreed by various WTO members and applied to cartels within the telecommunications industry. Evidence from the WTO policy and the outcome of this case could be used as an example for policy to govern the technology industry.

To further strengthen this point, the research evaluates the ability for the WTO to address issues of data compliance. Within the competition context, this has been viewed as a separate internet policy issue, causing complications in litigation against Big Tech where abuses of data are concerned. Conversely, the research finds that the WTO has put data and e-commerce high up on its agenda and has begun to deliver policy on trade of data. Member States have chosen to interpret the law differently, but evidence shows that many have formed initiatives to sanction data flows that it deems abusive from Big Tech Organisations. What is evident from the research, therefore, is that the WTO has a clear remit for data and privacy issues, as well as competition policy concerns, and is thus the best forum to address the anti-competitive nature of Big Tech. The research concludes by assessing the practical implications of the WTO as a global regulator for technology with suggestions presented on its structure and functions. It suggests that a similar structure to the global banking system be applied with duel regulators. The way this operates, is that one regulator be in charge of drafting and producing policy whilst the other acts as a prudential watchdog

supervising the industry. The former would operate as the WTO and with the substantive evidence presented of its viability as a forum for technology regulation, an outline of its practical application is presented to showcase how this would operate in practice. In terms of the prudential watchdog, inspiration is drawn from the global banking system and it is suggested that a Digital Market Authority be established. It would be made up of experts in competition, internet, and trade law, as well as industry experts in data and technology. It would cooperate with the WTO and require Big Tech Organisations to share information with it whilst performing reviews on technology firms worth over a certain turnover. It would assist in cross-border competition disputes and share information where required to aid investigations.

The purpose of this model is to allow innovation of technology to flourish whilst also protecting the consumer's rights from being abused by monopolistic big tech organisations. In a world where technology is rapidly changing, so too must the regulation of it in order to prevent Big Tech from becoming uncontrollably dominant, and this is best achieved by a comprehensive international approach. Please insert your revised abstract here one review feedback has been implemented and use indents for each new paragraph. Please insert your revised abstract here one review feedback has been implemented and use indents for each new paragraph. Please insert your revised abstract here one review feedback has been implemented and use indents for each new paragraph.

Great Britain's Electricity Grid and Net Zero: how to charge for use of the electricity grid?

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Key words: Electricity grid, Price signals, Use-of-system charges, time-of-use tariffs

The UK Government has committed to "Net Zero" greenhouse gas emission by 2050. Decarbonisation of Great Britain (GB)'s electricity system by 2030, and electrification of significant portions of our heat and transport – currently supplied largely by fossil fuels – are major enablers of the 2050 goal. The GB electricity grid was built many decades ago, largely around coal power stations. With sources such as wind and sun supplying far more of our current and future energy needs, we are going to need a grid that can use electricity sourced in different places, and at different times, while delivering energy to heat more of our homes and service more of our transport needs. The grid we've got will not get us to Net Zero. But what does the one we need look like? And how much "more grid" do we really need? UK's electricity and gas regulator, Ofgem, takes its "*lowest cost to consumers*" remit very seriously, and limits what the electricity network companies – all private companies, with shareholders - can build and charge customers for. Besides the question of what physical infrastructure we'll need, is the question of: how it will be financed? Currently, Britain's electricity network companies raise money from "users" of the electricity system - our bills - as allowed by the regulator, Ofgem. The apportionment of some of these costs is intended to be "cost-reflective", and hence, encourage most efficient use of our electricity system.

My research has been examining the plethora of elements of electricity network and system charging. I have reviewed academic thinking on how best to charge for use of electrical networks, and examined what we do here in Britain (for both national *transmission networks* and local lower-voltage *distribution networks*). In particular, I examined what incentives current arrangements place (if any) on both generators and energy consumers, regarding location and timing of outputs and consumption. I have also examined location of existing and proposed generators, and mapped these onto geographical areas of similar network charges.

An initial finding is that cost-reflectivity is evident in electricity network charges to large generators. Charges are low or even negative in the English South and Midlands, near Britain's biggest cities, however network charges are high in distant Scotland, because "more grid" is needed to transport electricity to (most) consumers. I have found that traditional generators, such as gas power stations, do generally locate where network charges are cheapest. However, no amount of network pricing signal has led to any hydro or significant windfarm anywhere onshore in England: there is less of wind, less space and much less chance of getting Planning approval.

Renewable generators locate where the best resource is: solar mainly in the south, wind mainly in the north, and hydro in the mountains, despite, rather than because of, pricing signals.

Regarding those who use electricity, and I have found there is little incentive on either location or timing on the most common tariffs. If we all were to plug in an electric vehicle at the same time, or during periods of high demand, this would overload our local grid connections.

My research argues that better signals in electricity network charges are needed. Improved signals (perhaps “time-of-use” tariffs) could encourage some electricity consumers to reduce consumption at peak times, and avoid overloading parts of the grid. Some industrial consumers might even consider locating to areas where electricity was cheaper – if incentives were strong enough – an aspect I hope to investigate further in a different branch of research.

There is a tension, between a “pay for what costs you cause” view, introduced with privatisation south of the border in the ‘90s, a view generally supported by academic literature, and social policy which encourages fairly uniform pricing of essential commodities such as electricity. Charging arrangements for British electricity networks have elements of both, and will continue to need both. In short, Britain will need “more electricity grid” to enable its transition to “net zero”. Finding enough flexibility enablers is likely to reduce the level of grid investment needed. But we need much improved approaches to charging for use of the electricity system, and appropriate pricing signals, to achieve this.

Neural networks for natural language processing and programming language processing

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Keywords: Natural Language Generation, Natural Language Processing, Natural language understanding, Deep Learning Attention Models, Programming Language Processing

The task of writing concise descriptions of code is known as source code summarization. Automatic code summarization is a dynamically growing field of research, especially since the community has embraced improvements in a neural networks. Source code summarising approaches, in general, take the source code as an input and outputs a plain language description. The topic of automatically creating summaries of computer subroutines is the focus of our research. To clarify, the input is a source code, and the output is a short, plain language description of that code snippet.

The study on source code summarization can be divided into 1) heuristic/template-driven approaches, and 2) more recent Data-driven approaches. Heuristic-based approaches for source code summarization started to gain popularity in 2010 with work done by Haiduc [1]. Here text retrieval techniques and latent semantic indexing (LSI) were utilised in their research to extract essential terms from source code, which were then considered the summary. Source code summarisation was also done using TF-IDF, LSI and LDA. The other way to approach this is a Data-driven approach. This method was inspired by neural machine translation. Here the sentence from one language say English was translated to another like Spanish. Based on input instances, a neural network based on the encoder-decoder model is used to learn the mapping between words as well as the correct grammatical structure from one language to the other. This works well since both the input and output languages are nearly identical length sequences, and word mappings are common across languages. However, evidence is mounting that the NMT metaphor has significant limitations. In comparison to the NMT use case, source code has considerably less words that transfer directly to summaries. The length of source code is usually substantially longer than the length of summaries. And, most importantly, source code isn't just a list of words. It was figured out that the more effective or efficient way to represent the source code was in the form of a graph or tree instead of sequence of tree [2].

Here we will be using ConvolutionalGraphNeuralNetworks(ConvGNNs). ConvGNNs take graph data and learn node representations from the starting node vector and its graph neighbours. Aggregation is the process of merging information from surrounding nodes. Working can be broadly classified into 5 steps [3]

Embed the AST node tokens and the source code sequence.

Use a recurrent layer for the source code token sequence and a ConvGNN for the AST nodes and edges to encode the embedding output.

To learn significant tokens in the source code and AST, use an attention technique.

The encoder outputs must be decoded.

Predict the sequence's next token.

The information from the Graph and Tree can be then used for summarisation. In this research work, the focus will be around development of Graphical Neural Networks (GNN) model for automatic code summarization and exploit how various GNN architectures and the degree of improvement in perform against traditional approaches.

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Validity of step-counting for global monitoring of physical activity among pre-school children

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Key words: Step-counting, Pedometers, Accelerometers, Early years, Global monitoring system,

Background: The World Health Organization (WHO) in 2019 recommended that pre-schoolers (3-4 years) spend at least 3 hours doing various physical activities every day for optimal health and development and highlighted the need for global monitoring of habitual physical activity in this age group. Low-cost measures, such as step-counting, may be essential for global monitoring of physical activity in pre-school children, yet the number of steps per day which correspond to 3 hours of physical activity per day in 3-4 year olds is unclear. Three previous studies have all suggested very different step-count thresholds which correspond to 3 hours of physical activity per day in 3-4 year olds. These are Gabel et al.[1] 6,000 steps/day, Vale et al.[2] 9,000 steps/day, and De Craemer et al.[3] 11,500 steps/day. The main aim of the present study was to identify the daily step count target corresponding to the 3 hours/day physical activity guideline in 3-4-year-olds from 13 countries.

Methods: This study included 352 pre-schoolers from 13 middle- and high-income countries who participated in the SUNRISE Study (https://sunrise-study.com/), an international cross-sectional study of movement behaviours in the early years. The level of physical activity (or movement behaviours) was measured accurately using the activPAL accelerometer which children wore on the thigh for at least three days. The activPAL also measures the number of steps taken per day, so the study could calibrate the step count against the physical activity measure. We then used area under the receiver operating curve (ROC-AUC) analysis, a performance measurement that distinguishes between positive (those meeting) and negative (those not meeting) classes, to assess the ability of three existing step-count thresholds to accurately classify achievement of the WHO guideline of at least 3 hours of physical activity per day in pre-schoolers using steps derived from the activPAL.

Results: Of the 352 pre-schoolers included in this study, 49.1% were girls. A slight majority (59.1%) lived in urban areas and over two-thirds (67.8%) were from lower- and upper-middle income countries. Children accumulated an average of 119 minutes/day of physical activity as measured by the activPAL activity monitor and accumulated an average of 8,784 steps/day. Of the three step-count thresholds tested, the De Craemer et al.[3] step-count cut-point of 11,500 steps/day provided excellent classification of meeting the physical activity guideline as measured by accelerometry (area under the curve (AUC): 0.945; 95% confidence interval: 0.928–0.961; Sensitivity: 100.0%; Specificity: 88.9%). Whilst the Vale et al.[2] and Gabel et al.[1] step-count cut-points showed fair and poor classifications, respectively.

Conclusion: There is currently no global monitoring of physical activity in early childhood, and one major barrier to an objective monitoring system is cost and complexity of the measurement method. The results of this study suggest that pedometer step-counting with a threshold of 11,500 steps/day provide an accurate low-cost option (e.g., costing as little as $26 USD) and could be used at both individual- and population-level monitoring of physical activity in early childhood.

Research Impact Chain – Changing People: Low levels of physical activity contribute to overweight and obesity in children and is also bad for development (e.g., cognitive development, social and emotional development, sleep). My research suggests that levels of physical activity of 3-4 year olds are too low globally, and we can monitor levels using a simple and cheap method (step counting with pedometers). Better monitoring globally would help raise awareness about physical activity in order to bring positive change (e.g. obesity control) among various people/populations especially in low- and middle-income countries. My research will help encourage valid and low-cost measures for population-based monitoring of physical activity to inform policy and practice to tackle obesity and prevent obesity-related diseases, such as diabetes, high blood pressure and some cancers.

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Indifference and Rigid Framing in Thai Sentencing Practice

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Keywords: Indifference, Rigid Framing, Inequality, Sentencing, Fines

Sentencing practice in Thailand has been criticised for inequality and over-harsh treatments. The normality of wealth-insensitive fines and imprisonment for fine default is clear evidence in support of this criticism. Persistence of the criticised practice despite ethical challenges implies judges' indifference to potential injustices of their court routines. However, little is known about whether judicial indifference exists and what has caused it. There have been too few socio-legal studies about Thai courts and the literature still leaves these questions unanswered. Knowing whether and how judicial indifference is behind Thai courts' sentencing patterns can potentially end the blame attribution debate on whether problematic practice persists because of 'bad' laws or 'bad' people. Ascertaining the true causes of impact-based unequal sentencing is crucial in developing optimal plans for criminal justice reform.

To fill this gap, this research investigates about Thai courts' indifference and its generating mechanisms. The research uses courts' routine for imposing the fine as a case study. This micro-focus enables a closer and more detailed inspection of how judges arrive at their routine decision-making. The fine, despite being a trivial penalty, suitably provides a window on inequality in Thai sentencing practice due to its frequent use and wealth-insensitive sentencing pattern. Employing ethnography and qualitative interviews, this research finds that Thai judges tend to be indifferent to inequality of penal outcomes, and that their indifference is a product of situational pressures in their work settings. Such indifference arises from the rigid and narrow frames about justice that judges have inadvertently adopted in their daily judging performance. The priority of form over substance, the dominating moralistic perceptions, and the preoccupation with managerial efficiency are the three frames that usually operate in concert. The multi-layered interaction of pressures from the dominant ideology, the organisational culture, and the proximate work environment creates the context conducive to rigid framing and its consequence of indifference. Therefore, it is neither solely the laws nor the people that are to blame for the entrenched inequality, but rather the aggregate of contextual factors.

Although focusing on the fine, these findings are capable of shedding lights on indifference in the overall Thai criminal proceedings. They caution that merely amendments to the legal texts or the top-down policy changes are unlikely to achieve meaningful reform. Likewise, the research underlines the need to seriously address situational underpinnings of rigid framing and indifference whenever criminal justice reform is attempted. It also encourages comparative studies of contextually influenced decision-making, not merely in the court settings but also across types of organisations, to help designing contexts conducive to making a good decision.

Working Towards Cheaper Catalysis

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Catalysis underpins modern synthetic chemistry, not only allowing for chemical transformations that wouldn't otherwise be possible, but also driving down the cost of reactions by decreasing the amount of energy required in a process. It often achieves this using metallic compounds that bind to organic centres and can bring molecules together, often with little additional energetic input. Modern catalysis is built upon the use of precious metals such as palladium, rhodium and iridium. These metals have a low crustal abundance, meaning that their supply could potentially be brought into question in the coming decades. They can also be prohibitively expensive, with a commonly used palladium salt ($PdCl_2$) costing ~£91 per gram. Palladium has been used in fine chemical, pharmaceutical, and agrochemical production and synthesis for a number of decades. This culminated in Akira Suzuki, Ei-ichi Negishi, and Richard Heck winning the 2010 Nobel Prize in Chemistry for palladium-catalysed cross coupling in organic synthesis. A cheaper alternative that has been at the pinnacle of recent research into more sustainable catalytic systems is nickel, due to its chemical similarity with palladium.

Nickel is swiftly gaining repute as the transition metal of choice in a number of catalytic processes, driven by unique reactivity, high abundance, and the resulting low-cost of many nickel salts used in pre-catalyst synthesis. However, there is a lot of ground to cover before it can be considered a complete peer of palladium, though this window closes with each passing year.

An example of an area that is currently unresolved in nickel catalysed C-C cross-coupling is that of ortho-substituted biaryl cross-coupling of aryl halides. This type of cross-coupling has a number of potential benefits in agrochemical and pharmaceutical development and production, including the potential for reduced cost of synthesis. To date however, little success has been found, with examples in literature either requiring high temperature reaction conditions (disfavoured in industrial processes due to energetic requirements) or being too low yielding (disfavoured in industrial processes due to increased cost of reactions). Literature examples have also only looked at fairly simple systems, such as 2-bromo-*m*-xylene coupled with phenylboronic acid, with few additional substituents on the aryl centre.

So far, the project has yielded some success in the synthesis of a number of new nickel pre-catalysts, with the hope that these complexes will pave the way for greater understanding of the problems faced in these catalytic reactions, and what the ideal conditions are for this complex biaryl cross-coupling. Herein, we report the newly found structures and the ways in which these structures will be used to elucidate new catalytic processes, with the hope they will be effective in cross-coupling reactions.

Behaviour is the climate change way forward

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Keywords: Entrepreneurial Mindset, Behaviour, Thinking, Emotion, Climate change.

This research seeks to explore the impact of stimulus input, cognition and emotions on the entrepreneurial process with the outcome being the behaviour or action. A conceptual framework intends to complement the existing recent exploratory framework on the Entrepreneurial Mindset triad, the triad being emotions, cognition and behaviour (Kuratko, Fisher and Audretsch, 2021).

This conceptual framework hopes to start more theory building and understanding of the layered entrepreneurial process. The attitudes to the framework will be examined in terms of changes to behaviour from cognitive and emotional aspects and subsequent changes to behaviour and identifying whether they work separately and/or complement each other.

A case study strategy is to be used, this is because the research questions are to be why and how questions and the data collection methods used are to be largely unstructured interviews, with one starter question and the dialogue will continue from there (Yin, 2018) How many interviews there are will depend on when saturation is reached. Saturation will be when nothing new can be uncovered by more interviews (Guba and Lincoln, 1989). That way it is possible to use the analysis of data to reach the end goal/headline of finding a conceptual framework. This can be used as a narrative for entrepreneurship education to change behaviour.

This research should contribute to other qualitative studies of the entrepreneurial mindset being done within entrepreneurship and education. The objective is to explore the underlying themes to develop more discussion on the interdependent nature of the emotional, cognitive, and behavioural aspects using entrepreneurial education.

The future implications could be that more is known about the working of the entrepreneurial mindset so that the future behaviour of entrepreneurs can be changed. Entrepreneurial education could then be targeted at changing behaviour that impacts climate change.

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Raising attainment in the Scottish secondary school: A theoretical exploration of how the policy of raising attainment influences the practice of the Curricular Principal Teacher

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Keywords: Education, Middle Leadership, Scottish, Policy, Attainment

This study explores the practice of the Curricular Principal Teacher (CPT) in enacting the Scottish education policy of raising attainment in the senior phase of secondary education using Cultural Historical Activity Theory as a theoretical framework.

The Curricular Principal Teacher (CPT) is responsible for leading subject specialist classroom teachers in all aspects of the delivery of a subject, or subjects, within the Scottish secondary school curriculum. This secondary school middle leadership role has changed considerably in the last 20 years, from a largely autonomous and administrative role with little accountability to or contact from senior school management to that of a sophisticated middle management position governed by a range of national standards. The Scottish secondary school CPT in the 21st century is now accountable to senior management for the implementation of flagship Scottish government policy objectives such as raising attainment which are filtered down from local authorities to schools ("Education: improvement framework and plan - 2021 - gov.scot", 2022).

Research within the field of middle leadership has fallen out of favour recently, with any contemporary research tending to be under theorised and focused on the practicality of mundane roles and responsibilities that the CPT undertakes such as allocating classes to teachers, managing a budget or writing plans and reports (De Nobile 2018). It is argued further that the role of the middle leader in schools has transformed to the point that previous research may even not be applicable today (Harris & Jones 2017).

Through an exploration of the practices of the CPT using Cultural Historical Activity Theory as a theoretical framework, the findings from this research offer a theoretical understanding of how the CPT enacts the flagship Scottish education policy of raising attainment in Scottish secondary schools

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Education or Socialisation - Sustaining Intention in Intentional Communities

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Keywords: Intentional Community, Educational Aims, Inner Listening, Peace Education, Education for Subjectification

Education is probably one of the most civilised tools to achieve society's aims. The last two years have laid bare the challenges of self-interest, entitlement, and disregard for collective benefit. Should education provide critical thinkers who challenge the status quo, or should it lead to people following the existing order because it is easier to become a cog than to challenge the social formats? Gert Biesta defines three aims of education. He talks about the qualification that allows us to be competent at whatever career path we choose, socialisation that enables us to become a part of the existing social order and subjectification that equips us to challenge the system to help create a different future.

What could this different future look like, and is it only fictional or in the philosophy books? There are microcosms where people actively experiment with radical social structures of living together. Some people choose to live in communities with lifestyles that may be influenced by social, political, religious, spiritual, or environmental beliefs. This subset of society is actively challenging the mainstream culture and provides an opportunity to liminally experience another possibility.

My research focuses on an Intentional Community where people have chosen to live together, guided by a spiritual common ground demonstrated through practices like inner listening, which they define as "accessing a still small voice within." In its last 50 years, the community has globally contributed to discussions on community living and presented a unique learning opportunity for me. Using this Intentional Community as a case study, I wish to explore if the commitment to the practices has any relation to the overall effectiveness of how people live together, solve conflicts, and relate to being members of the community. Does the focus on inner voice impact how they see themselves and their fellow community members differently than they would have if not in the community?

I am studying the practice of inner listening, its evolution from the autobiographical narratives of founders and early members to the way it is practised today and its connection to the commitment of being in the community. Further, I explore how the intentional community uses the concepts of socialisation and subjectification through the practice of inner listening to sustain their social order and practices.

The challenges of education for a society that is caring, compassionate and conscious of its impact on nature and at the same time guided by principles of equality,

social justice and peaceful coexistence seem to be at the forefront. Does this Intentional community have any answers? Maybe not, but is there some opportunity to gain insights that could help the way we design education for a better society? That is to be seen.

Examining the Interplay Between HMGB1 Release and Thrombin: The Role of Thrombin receptor in HMGB1 Regulation

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Key words: HMGB1, Thrombin, PAR4, Thrombosis, Cardiac hypertrophy model

Background: Diseases associated with blood clots and associated inflammation of the heart are one of the leading causes of death worldwide, with platelets being the key cellular component of clot formation. At the molecular level, interactions between substances secreted from the immune system, cytokines, and platelet receptors are associated with abnormal platelet function and represent an avenue for the development of new antiplatelet therapies. The cytokine-like activity of a specific pro-inflammatory protein, high mobility group box 1 (HMGB1), has recently been implicated in clotting, with new roles identified in processes that lead to thickening of the heart wall (cardiac hypertrophy) [1]. Evidence suggests interaction between HMGB1 and the blood-clotting enzyme thrombin via protease-activated receptors (PARs), however the mechanisms are unclear [2]. The aim of this project was to investigate molecular interaction between HMGB1 and thrombin-mediated PAR activity.

Methods: A primary megakaryoblastic cell line (MEG-01) was used in this study, which have been proposed to express PAR4 and HMGB1. MEG-01 cells release platelet like particles (PLPs) which may mimic platelets found in the bloodstream. Dynamic light scattering (DLS) analysis and brightfield visualisation were used to validate the heterogeneity of MEG-01 cell populations to distinguish PLP and extracellular particle release. Microscopy was then used to determine the characteristics of MEG-01 and associated PLP release with western blotting and indirect immunofluorescence used to detect HMGB1 and PAR4 expression and localisation.

Results and future work: MEG-01 cell analysis by DLS confirmed various cell particle sizes ranging from populations detected in (0-2nm) and (10-150nm), the cargo of which is currently being characterised more comprehensively. MEG-01 cells express PAR4, with clear localisation of HMGB1 evident in the nucleus. Different stages of MEG cell maturation and the active release of particles were evident between basal and thrombin-stimulated conditions (0-120mins). Changes in expression and localisation of the HMGB1 and PAR4 in MEG-01 cells were also confirmed at 5-15 mins post-thrombin treatment. Active secretion of HMBG1 was detected in response to thrombin. To appreciate the implications of thrombin-dependent release of HMGB1 more fully, we have established a rat model of cardiac hypertrophy to assess the pathological importance of these events. Work is now under way to assess the role of these interactions in this disease model. This may lead to

new avenues to develop novel treatment options that limit the complex clotting pathways that lead to inflammation in the heart.

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