Welcome

Professor Neil Quigley
Vice-Chancellor

The University of Waikato Summer Research Scholarship Programme was established in 2006 to support and enhance research at the University of Waikato. The Programme provides exceptional students with the opportunity to experience the challenges and rewards of research.

Academic staff who supervise summer research projects gain the opportunity to choose exceptional and enthusiastic students to work on research projects that may lead to publications, opportunities to gain external funding, and which ultimately may enhance, or plant the seed to grow, relationships with external organisations.

Summer research students also benefit from the opportunity to gain hands-on experience in a relevant research project, enhancing their skill-set and providing opportunities for future employment; for many the Programme provides the stimulus to undertake further postgraduate study.

The Programme also enables the University to provide research outcomes for our external stakeholders across the Waikato and neighbouring regions.

The future success of the Programme lies in collaboration with our external partners, and I look forward to enhancing our fully and match-funded summer research scholarship opportunities in the future.

Professor Bryony James
Deputy Vice-Chancellor Research

The richness of university life lies, in large part, at the intersection of research and teaching. This is perhaps best embodied when our students embark on their own research journey. The first such journey for some of our most exceptional students is the Summer Research Scholarship Programme, which pairs our world-leading academic researchers with the emerging disciplinary excellence of our top students.

The students get a taste of the exhilarating step into the unknown that is research, contributing a piece of understanding to the broader body of knowledge in their chosen field. Our academic staff get the opportunity to be immersed in the enthusiasm and energy of some of our most accomplished students as they discover that knowledge you learn is cool, but knowledge you create is so much cooler!

The SRS programme also allows our external partners to support research to achieve their own aspirations. A short time frame, an enthusiastic and accomplished student, and a leading academic supervisor contribute to highly productive research collaborations with local industries and businesses. We look forward to growing the number of fully funded and match-funded scholarships to allow our stakeholders across the region to access the research excellence of Te Whare Wānanga – The University of Waikato.
Summer Research Scholarship recipients from 2021/22

Jessie Burnette
Stance in Social Media - the language of taking sides during a pandemic
Division of Arts, Law, Psychology and Social Sciences

Jessie Burnette spent the summer investigating the language of persuasion in #Covid19nz Twitter posts.

Experienced supervisor Dr Andreea Calude, a senior lecturer and Linguistics convenor at Waikato University, supported her in this timely research.

Using Twitter data, Jessie examined the different linguistic strategies tweeters used to direct others and influence their future actions.

While research into this type of language – directives – is not new, a study of directive use in naturally occurring social media language is.

The project provided a valuable opportunity to experience linguistics’ research in a fun and safe environment.

“It can be quite intimidating when you are beginning your first research project. This was an exploratory study, so sifting through tweets without being sure what I would find was overwhelming at times.

“That was where being able to turn to my supervisor was so helpful. In the end, realising that we’d found some cool patterns that could contribute to the field was such an amazing feeling.”

Jessie’s work involved analysing 1001 tweets, separating out directive clauses, and coding them for stance towards Government Covid-19 measures before further examining which linguistic features tweeters used to formulate their directives.

Once she completed the coding process, she then compared the coded language features found in directive tweets against their stance towards Government measures.

Stance largely fell into three delineated categories: opposed to Government measures, for Government measures, or calling for stronger measures. The stance toward measures seemed to influence the linguistic strategies used by tweeters when constructing directives.

The most salient linguistic features included politeness strategies and chosen grammatical construction, while a range of additional discourse features (such as vocative noun phrases, expletives, and Māori loanwords) helped generate a more detailed image of the data.

Jessie used this data to uncover several larger patterns of language use. One such pattern was the preference shown by all stance groups for direct, bald on-record imperatives (such as 'Stay home!').

Tweeters used this strategy the most in tweets supportive of Government measures. As the most prominent stance group, and therefore representative of the status quo, these users tended to avoid mitigating strategies in favour of blunt, direct commands more likely viewed as rude in face-to-face conversation.

In contrast, tweets calling for stronger Government measures tended to use the most indirect, polite approaches, but were simultaneously the most likely to use vocative noun phrases to call out specific individuals or organisations – those who they felt were able to best respond to their demands.

This summer research project has since grown into a full paper currently under review and has continued to shape Jessie’s current work.

As a Master’s student completing a degree in English, she utilises an interdisciplinary Medical Humanities approach drawing on both English and Linguistics to further investigate aspects of public engagement with Covid-19 on Twitter.
Emergency online learning during the Covid 19 pandemic in 2020 made students distressed and uncomfortable, David Simes’ Summer Research Scholarship project found.

Long-term home learning caused disturbance and deterioration in students’ study habits and performance of work resulting in growth of stress and dysfunctional learning behaviours.

David, who led the project, was assisted by Dr Nicole Pepperell and Dr Alison Jolley from Te Puna Ako - Centre for Tertiary Teaching & Learning (CeTTL).

To recruit students for the project, they sent a mass email to selected class lists inviting recipients to a landing site where they confirmed their availability for an interview.

At the time David was studying for his Master of Arts in English, and working as a sessional assistant, so could see both sides of the struggle with the rapid shift to online learning.

“Communication and technical issues plus the inability to socialise and connect with peers had a negative impact on students and their willingness to study,” says David.

This resulted in a lack of motivation and raised doubts about how well students interviewed were dealing with the situation in relation to other students.

“Responses within the literature review show that students were comfortable continuing with their studies online but did not see it as a desirable alternative, rather it was a means to an end.”

David wants to use the research project to show how Waikato students responded to e-learning compared to students globally.

“Already there is literature which shows students in Middle Eastern and Asian countries were frustrated, anxious and bored. They had concerns about future education prospects, employability and career opportunities,” says David.
Summer Research Scholarship Programme 2021/22

Sarah Hall
The Science of Story: Can Hollywood Help Scientists Communicate?
Division of Arts, Law, Psychology and Social Sciences

We are constantly reminded that we need more people to study and practice science.

If science discovery and information were communicated more effectively, would people gain a better understanding of it and be more inclined to take it up as a career or make better use of it in their daily lives?

That’s what University of Waikato PhD student Sarah Hall wants to find out as part of her research.

Sarah says it was her Summer Research Scholarship at Waikato that sparked an interest in scientific research, and ultimately drew her to what’s now become her thesis topic.

For her first summer research scholarship, she worked with internationally renowned memory expert Professor Maryanne Garry to gather evidence about the qualities of people’s traumatic memories and how they compared with negative, positive or neutral memories.

“There is a widespread idea in both the psychological literature and popular culture that people’s memories for trauma are fragmented and remembered in bits and pieces out of order; that is, they are incoherent,” Sarah says.

“It turns out people’s traumatic memories are just as coherent as their non-traumatic memories. These findings fit with the growing body of evidence to suggest, contrary to popular belief, people’s traumatic memories are recalled in much the same ways as non-traumatic memories.”

While this scholarship research wasn’t directly related to what would later become her doctoral study, Sarah says it gave her good research experience and encouraged her to continue pursuing research.

Sarah was home-schooled in Hokitika, came north for work, and found herself drawn to university.

She enrolled at Waikato and completed a Bachelor of Social Sciences with a major in Psychology and a minor in Philosophy.

She did her summer research before embarking on her honours year, which was the beginning of her study into science communication.

“Scientific communication poses a challenge,” Sarah says. “Ideally you want to clearly highlight the issue being addressed at each stage in a study, any key conclusions and implications while fully acknowledging the limitations of the evidence.”

A proposed theory for highlighting issues being addressed throughout a study is using ‘but’ rather than ‘and’ to draw attention to a conflict.

“Highlighting a conflict may then increase reader interest and understanding,” Sarah says.

She studied more than 500 journal articles investigating whether a higher ratio of ‘but’ to ‘and’ was associated with more citations (a measure of impact). She found little difference to support that theory.

Her second summer research scholarship followed on from the communication study, looking at broader measures such as engagement on social media.

“We again found little difference to support the idea that a higher ratio of ‘but’ to ‘and’ was associated with more impact,” she says.

There’s a scarcity of literature that directly evaluates science communication efforts and so for her PhD research Sarah’s investigating what makes scientific communication effective.

Alongside the ‘but’ and ‘and’ research, she’ll be looking at the use of plain English, and quality of evidence.

“And I’ll also be looking at the dark side of science: when these writing techniques don’t lead to effective scientific communication but instead have the potential to spread misinformation,” she says.

”
Sophia Harrison, former head girl at Melville High School, a participant in the nationwide Tuia Rangatahi leadership programme and Bachelor of Social Sciences graduate, has her University of Waikato Summer Research Scholarship to thank for setting her on the road towards becoming a clinical psychologist.

Sophia (Ngāti Rongomaiwahine, Ngāti Kahungunu, Ngāti Porou) came to Waikato from high school to study for a Bachelor of Social Sciences with majors in Māori and Indigenous Studies and Geography. In her second year she applied for and was awarded a Summer Research Scholarship.

She worked in Te Pua Wānanga ki te Ao Faculty of Māori and Indigenous Studies with lecturer Hineitimoana Greensill, researching Māori and Pacific approaches to sustainability. Her findings would contribute to the third-year paper Sustainability in Māori, Pacific, and Indigenous Contexts.

"The paper already had a strong Māori and North and South American – First Nations focus and I thought it was important to strengthen the Māori perspective even more and also increase Pacific and Indigenous Australian perspectives in the paper. But particularly Māori voices as tangata whenua," says Sophia.

Her research focused on audiovisual rather than academic texts, coming to her subject from a more creative perspective, including poetry, art and creative media. She already had a lot of information on Indigenous activists and "I kind of went from there", she says.

Sophia could do a lot of her research from home, but she preferred to come to campus where she worked alongside other young Māori researchers and long-admired academics.

"And they were all wāhine pursuing these careers and doing research, and I thought, 'I can be like you'."

She enjoyed that experience so much she asked her supervisor if there was something else she could do in the research field during her final year. Ms Greensill put her on to senior lecturer Dr Waikaremoana Waitoki, a clinical psychologist with work and research interests in Kaupapa Māori psychology, adult mental health, and child and adolescent mental health.

Sophia was taken on as Ms Waitoki’s research assistant, and by the end of the year she was hooked on psychology.

In 2022 Sophia is going to Otago to study for a Graduate Diploma in Psychology and believes it’s thanks in part to her summer research scholarship that she became interested in pursuing clinical psychology.

While there may not be any obvious link between Māori and Indigenous studies and Psychology, Sophia thinks her previous study will be useful in providing context and much needed perspective.

Her Human Geography major had a health perspective, focusing on space, identity and their impacts on health and wellbeing – “the postcode influence” on people and communities.

Overall, Sophia says her university study to date, but her summer research in particular, has increased her appreciation of the whakapapa relationship between people and the environment.

"As Māori we call ourselves tangata whenua – people of the land, but how many of us are actually people of the land and people for the land? Are we being good whānau members to the whenua and environment?" she says.
Robbie Maris
Understanding profitability and efficiency of dairy farms in the Waikato
Waikato Management School

Studying the unexpected combination of Economics and Chemistry is opening doors for Robbie Maris.

He’s just completed a Bachelor of Business at the University of Waikato, majoring in those two subjects, and is moving on to a Master of Management Studies.

Robbie was the recipient of two University of Waikato Summer Research Scholarships, which he says gave him a good insight into research processes and a taste for where his degrees might take him in the future.

His first scholarship was with the Bay of Plenty economic development agency Priority One, based in his hometown of Tauranga, where he worked on a pilot study building a business case for seaweed farming in the Bay with the potential to expand throughout New Zealand.

In partnership with iwi and local farmers, the pilot is focused on creating a viable community model from seed to sale using a regenerative ocean farming model.

Robbie’s second Summer Research Scholarship was with DairyNZ. He was tasked with looking at dairy farm performance and efficiency.

“My focus was on farm operating profit margin, looking at what characteristics and practices on-farm improve those margins, and what drivers influence them,” he says.

“It’s something farmers are dealing with all the time, and it’s actually very easy to calculate relative to more complex theoretical models of efficiency and farm performance.

“Farmers don’t have time for those, so if they can look at their operating profit margins, compare them with industry benchmarks, they can see how changing practices can improve resilience and efficiency.”

Robbie presented his research (virtually) in February 2022 at the 66th Annual Australasian Agricultural Resource and Economic Society’s conference.

Lately he’s been based in Auckland working on what he considers a perfect fit for his study skills. He’s been interning at EnviroStrat Ltd, a multidisciplinary organisation that brings together science, economics and commercial elements to develop impact-focused projects that deliver positive financial returns and measurable environmental improvements.

“I didn’t know something so perfect existed. It’s definitely the type of work I’d like to do in future,” Robbie says.

“I don’t know where I’ll end up, but even if I do end up doing pure economics, I’ll have had good experiences and gained different perspectives of both science and business.”

Robbie was also awarded a University of Waikato Research Masters Scholarship in 2022.

He also received funding to support his master’s study from Manaaki Whenua Landcare Research to investigate ways to increase community participation in conservation.

His research will contribute to the Biological Heritage National Science Challenge and take him off campus and on the road as he meets with community groups up and down the country to see what they’re doing and what more can be done to develop programmes, policies and interventions that will lead to increased awareness and participation, and ultimately improve conservation practices.
Caleb Crosbie
How close are we to the temperature tipping point of the marine biosphere?

Division of Health, Engineering, Computing and Science

Caleb Crosbie spent his summer research project knee-deep in Tauranga’s carbon rich tidal flats, and it whetted his appetite to do even more research for his master’s in the coastal environment.

Caleb investigated whether global change has had an impact on marine sediment communities, such as tidal flats. He also looked at samples along the Bay of Plenty coastline from Thames through to Whakatāne.

Tidal or mud flats are part of coastal foreshores covered and uncovered by the rise and fall of the tide. They are important ecosystems which provide habitat for many fish, bird and marine species.

Caleb looked at whether the increased temperature as well as nutrients in the surface layer would induce greater respiration rates and therefore greater nutrient cycling from both organic material and stored carbon sources.

“This is applicable to the study I did last year looking at nutrient loads in mangrove soils and short-term cycling of carbon,” says Caleb, who completed his Bachelor of Science in Environmental Sciences last year.

“With this year’s project, we found that all samples exhibited increased respiration rates at higher temperatures, giving evidence that more carbon dioxide will be leaving the system due to increased respiration than being absorbed by photosynthesis.”

It also suggests that an increased nutrient load in the surface water could lead to dissolution of carbon from the soil stores by increased microbial activity at lower temperatures, which means the mangroves and intertidal sediments could switch from acting as a carbon sink to a carbon source, says Caleb.

Tidal flats contain plenty of carbon dioxide stored in the form of organic material. Microbial communities break down the carbon created by primary producers like algae and seaweed and introduce it into the sediment.

The main part of his research project involved heating the sediment up, adding glucose and seeing whether the amount of CO2 released from the soil increased.

Caleb’s research has him now asking the question about when the global warming tipping point might occur. That would see more carbon dioxide released to the atmosphere rather than being removed.

The results have implications for our warming world, he says.

“Will marine sediments become more or less of a carbon dioxide sink in the future?”

Caleb’s research project was like other projects researchers had done on the land but was the first of its type in mud flats.

“We could see from the study quite a lot of similarities to what happens on land soils.”

Caleb was living in Singapore until starting at the University’s Tauranga campus in 2019.

“I’ve always loved the ocean and for me being able to work in the tidal flats doing this research is rewarding.”

He is conscious that as a scientist he is uncovering problems, so he wants to be part of the solution.

“This project has been a great opportunity to build on my research investigating the effect of warming temperatures and the effect on carbon stores within intertidal sediment.”

He wants to expand this research into a master research topic to cover a greater area of New Zealand coastline.
Taryn Farr
Suicide by cop. Analysis of New Zealand cases
Division of Health, Engineering, Computing and Science

Taryn Farr never saw herself as a criminal psychologist, but after two University of Waikato Summer Research Scholarships looking at aspects of crime, she thinks she may have found her calling.

Taryn has just completed a Bachelor of Social Sciences at the University of Waikato majoring in Psychology and Public Relations and is now completing an honours year in Psychology. She hasn’t shied away from hard topics.

Working in conjunction with staff from the University’s health team, Associate Professor Anthony O’Brien and Graham Holman, Taryn has been investigating ‘suicide by cop’ – when someone has committed a crime, is being pursued by the police and decides that they would rather commit suicide than be arrested, or when people who are already contemplating suicide and decide that provoking law enforcement into killing them is the best way to act to achieve their objective (the Aramoana massacre in 1990 was one such instance of the offender shouting at police to kill him.)

Taryn was looking at common factors across cases in New Zealand. What surprised her was the number of this type of police shootings there have been. She’s still doing a lot of cross referencing, working on collating and assessing the results of her research.

“I really didn’t go to university thinking this’d be the path I’d go down,” Taryn says. “The first summer research scholarship made me realise the different avenues you can go [in psychology]. There are so many opportunities and once you take up one, other random ones open up for you.”

That first summer research scholarship saw her working the Department of Internal Affairs to study the psychology of terrorists and how they become radicalised online. Her supervisor was Dr Andrew Evelo who is conducting a research project on reducing extremism in New Zealand.

Radicalisation is defined as ‘the process whereby an individual adopts extreme religious, social or political ideals’ and usually happens when two conditions are present. First, there has to be a person or group that holds a specific point of view and wants to recruit people to support them or take action on their behalf. And secondly, individuals being targeted will more often than not share common characteristics or circumstances and have some form of vulnerability.

It’s this area of research that Taryn plans to focus on for her honours study – furthering her work to understand the processes and effects of radicalisation.

And she says while Public Relations and Psychology aren’t a common combination, she’s found it a useful pairing.

“I hadn’t planned to study PR, but I did some communications papers and found I enjoyed them, and I think studying communication has given me the skills to explain what can often be complicated ideas in a clear and concise way.”

Taryn says she’d definitely recommend doing a Summer Research Scholarship.

“I had no idea of all the opportunities and connections that would open up from it. I’ve been really fortunate to have worked with some experienced people and have learnt a lot of new skills from working with them and putting the research process into practice.”
How to get involved in the Summer Research Scholarship Programme

**Academic Staff**

Staff who want to be involved in the programme may apply for funding from the University. Alternatively, staff may use external funding (e.g. Marsden grant) and/or seek co-funding from partners. Academic staff are invited to submit project proposals for consideration for university funding by June each year. This includes applications for full-funded and co-funded projects. Each project needs to be research, and designed to be completed by one student over a maximum period of 10 weeks of full-time research from November to February.

When selecting projects, the panel will consider the subject area, external partnerships, and will be influenced by the University’s research strategy. If using external funding, staff may apply to have projects included on the programme up until the end of October.

**Students**

Students seeking a place on the Summer Research Scholarship Programme should:

- Keep an eye on the Scholarships Finder online at [waikato.ac.nz/scholarships](http://waikato.ac.nz/scholarships) from mid-August when the projects are advertised.
- Read the regulations and project offerings, ensuring eligibility, and that application documents are submitted on time.
- If possible, speak to potential supervisors to ensure the project is a good fit for you.

**External parties**

If you are an external sponsor and have a research idea and are interested in supporting a Summer Research Scholar please review the [Guidelines for External Sponsors](http://waikato.ac.nz/scholarships).

Please note that the project must be research, not a work placement and Summer Research Scholars are required to have a University of Waikato academic supervisor in place. We may be able to assist with meeting these requirements.

If, after reading the [Guidelines for External Sponsors](http://waikato.ac.nz/scholarships), you have further questions, please email scholarships@waikato.ac.nz.
Initially encountering pictographic Kanji causes people to overestimate their knowledge of Kanji

**METHOD**

- **Participants** learned 15 Kanji alongside an image of their meaning
  - **Manipulated Kanji order**
  - "Easy" first
  - "Hard" first
- **Participants estimated how many of the Kanji shown they could translate if tested**
- **Given translation test of Kanji shown**

**RESULTS**

- **Mean difference between estimated and actual test score (%)**
  - **Overestimating test performance**
  - **Underestimating test performance**

<table>
<thead>
<tr>
<th>Easy Kanji first</th>
<th>Hard Kanji first</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mdiff = 1.87 [-4.95, 8.69], p = .59</td>
<td>Mdiff = 9.91 [3.36, 16.46], p = .01</td>
</tr>
</tbody>
</table>

**DISCUSSION**

- Both people who saw "easy" Kanji first and "hard" Kanji first predicted that they would do similarly well on the test
  - Mdiff = 53.38, Mdiff = 51.51, Mdiff = 1.87 [4.95, 8.69], p = .59
- In reality, people who saw "hard" Kanji first did better on the test than those who saw "easy" Kanji first
  - Mdiff = 49.84, Mdiff = 59.75, Mdiff = 9.91 [3.36, 16.46], p = .01
- Relative to their actual scores, people who saw "easy" Kanji first slightly overestimated their test scores, and people who saw "hard" Kanji first underestimated their test scores
  - Mdiff = 3.54, Mdiff = -8.25, Mdiff = 11.79 [4.08, 19.50], p = .01
- Our results suggest that the order in which we learn information affects not only how much we think we learned, but how much we actually do learn

**RESEARCH QUESTION**

When people encounter a series of novel kanji, to what extent does beginning with pictographic Kanji lead them to overestimate their skill at Kanji?
Adapting Mirror- and Interpersonal-Gazing Tasks To Induce Mild Dissociative Experiences Online

Way Ming Chan, Mevagh Sanson, Maryanne Garry

Background

- Sometimes people experience disruptions in their sense of self, or perceptions of the world—in other words, they dissociate (APA, 2013).

- Psychological science largely focuses on pathological dissociation, meaning we know little about the dissociation that healthy people experience (Butler, 2011; Merckelbach & Muris, 2001).

- To learn more about this kind of dissociation, we must be able to reliably induce dissociative experiences.

- Two tasks reliably induce mild dissociative experiences in the lab: staring, at length, into one’s own eyes—mirror gazing—and staring into other’s eyes—interpersonal gazing (Caputo, 2010; 2019).

- But these tasks are hard to use at scale: they must be completed individually, in-person, and in dim lighting, limiting their utility.

- Adapting these tasks for use online would overcome this limitation. But we do not know how reliably they would induce dissociative experiences when completed online.

Research Question

To what extent do people report dissociative experiences when they complete a mirror- or interpersonal-gaze task online?

Results & Discussion

- These results suggest completing mirror- and interpersonal-gaze tasks online induce dissociative experience.

  - One “mirror-gaze” subject reported: “I saw wrinkles around my face, and I saw the edges of my face elongate and congeal.”

  - One “interpersonal-gaze” subject reported: “…his shirt was a solid colour, and it changed to patterned polka-dots…his face went from sweet, kind looking to scary and nerve-wracking.”

- But, compared to previous in-person studies, fewer of our subjects reported dissociative experiences (Caputo, 2010).

  - It is possible that the camera feed was not of the right size, due to subjects sitting either too close or far away from their screens.

  - These tasks should be refined in future work to more reliably induce dissociative experiences to facilitate study of “healthy” dissociation.

References


• Transgender people face important health inequities, with most serious ones relating to mental health (e.g. a higher likelihood of committing suicide; Christian et al., 2018). Health inequities have been linked to underlying social determinants such as enacted stigma (Fega & Veale, 2015).

• The first wave of Counting Ourselves (2018) found transgender people in New Zealand were 22 times more likely to report high psychological distress and 4.6 times more likely to report sexual violence, than the general population (Veale et al., 2019).

• A transgender-specific survey is needed to monitor these inequities and social determinants; New Zealand population-based surveys (some) have only recently started to collect data on whether participants are transgender (Stats NZ, 2021), and do not monitor transgender-specific issues.

Research questions
1. What progress is Aotearoa making to reduce the inequities uncovered in the first Counting Ourselves survey in 2018?
2. What changes are there in the social determinants that underpin these health inequities, such as enacted stigma experiences and healthcare access barriers?
3. What are the emerging issues for transgender people in Aotearoa New Zealand associated with health inequities?

References


Preparation and Notation for Baroque Violin & Continuo publications

Background:
The Baroque period occurred over 270 years ago, from about 1600 to 1750.
The most popular instruments from this period include:

The Violin gained popularity in the Baroque period so much that it was elevated to being the core instrument of orchestral music.
The Continuo part in Baroque music is a bass part that can be played by one of the following instruments: Keyboard, Harpsichord, Organ, Guitar, Lute, Cello, Double bass, Bass Viol or Bassoon.

The purpose/importance of this type of research is that it enables pieces from the Baroque period, that haven’t been heard for over 200 years, to be performed, taught, and recorded for many more years to come.

Method/Aim:
- To seek out and input information about all Baroque Violin and Continuo pieces available on the music scores website, IMSLP.
- To then notate some of the unpublished pieces on Sibelius (as chosen by Dr Lara Hall).

Interesting discoveries from my project:
- These Baroque pieces showcased the expansion of the violins performance range, notable use of slurs, double and triple stopping, and some of the first notated tremolos.
- There were a lot of composers whose works were anonymous or attributed incorrectly.
- Often there was only one copy of the handwritten piece, since there was no ability to print, hence the scanned pieces I notated from, were most likely the only copy available.
- Pieces were often dedicated to people in royal families as they would have often been the composers employers.
- Some of the pieces stated the instrumentation was intended for a ‘treble instrument’ and continuo. Therefore, this could be played by one of the following: Musette, Vielle, Flute, Oboe, Violin, Recorder, etc.

Conclusion/Results:
This project resulted in all 951 pieces, available on IMSLP, having their information inputted into an excel spreadsheet which will be available for the University of Waikato Music Department and stakeholders, particularly Dr Lara Hall (Lecturer in Violin and Viola) to play, teach, or record.
I was also able to notate about 15 pieces in Sibelius, by the composer Franz Benda, which is about 200 pages of music that haven’t been seen/heard since the Baroque period. These have the opportunity of being played and potentially recorded in the future by Dr Lara Hall, before being enjoyed by many Violin students and professionals in Chamber performances.

Exemplar of my notation, of Violin Sonata in B minor, L3 139 by Franz Benda:
The top photo is Benda’s original handwritten score, and the bottom photo is my Sibelius notation of the work.

References:
- “Scores featuring the violin & Baroque style & For violin, continuo” (2022), IMSLP
- “The World’s Largest Library Catalog.” (2022), WorldCat.org

I would like to express my gratitude to the University of Waikato for providing this Summer Research Scholarship opportunity. I would also like thank Dr Lara Hall for supervising this project.
Sneha Kant
Division of Arts, Law, Psychology and Social Sciences

**UNDRESSING THE PATRIARCHAL POWER THAT LOOMS OVER NEW ZEALAND’S REVENGE PORNGRAPHY LAWS**

**BY:** Sneha Kant
**SUPERVISORS:** Wayne Rumbles, Richman Wee and Fleur Mullen
Te Piringa, Faculty of Law

**defining revenge porn**
The distribution of sexually graphic images of individuals without their consent. This includes both images originally obtained without consent (for example by using hidden cameras, hacking phones, recording sexual assaults or affairs) as well as images consensually obtained within the context of an intimate relationship.

**research method**
Literature review, focusing on New Zealand legislation, journal articles and the General Data Protection Regulation (GDPR).

**legal issue:**
Does the New Zealand legislative cybersecurity framework, namely the Harmful Digital Communications Act 2015 (HDCA), adequately serve its purpose to prevent and mitigate harm to victims of revenge pornography?

**findings:**
The HDCA and prior case law such as *R v Iyer* set a high threshold to satisfy the legal test for harm, thus leading to a miscarriage of justice.

**potential reform:**
- The HDCA Amendment Bill removes the need for Police to establish that the perpetrator intended to cause serious harm.
- Adopting the GDPR, the Bill also makes it an offence to share intimate materials of another without express consent.
- Parliament could also segregate revenge porn as a tort in its own right. This would provide further protection against online predators of male voyeurism and be read in conjunction with the HDCA Amendment Bill.

**case law**
The case of *R v Iyer* was the first case to apply the guiding principles of the HDCA and distinguish the interpretation of ‘harm’ as per section 22(2) of the HDCA. The ruling of this case held that the malicious display of the victim’s semi-nudes by her ex-husband did not cause sufficient ‘serious emotional distress’ to satisfy the legal test for harm.

**findings:**
- The HDCA and prior case law such as *R v Iyer* set a high threshold to satisfy the legal test for harm, thus leading to a miscarriage of justice.

**ACKNOWLEDGEMENTS:**
This research was conducted for the Technology in Legal Education New Zealand Project supported by the New Zealand Law Foundation.
WHAT WORKS IN RELATION TO BODY POSITIVE INITIATIVES?

Chloe Phillips, supervised by Professor Katrina Roen (UoW) and Rikki Anderson (YWCA)

Engaging girls, young women, and non-binary youth in body positive initiatives that affirm diversity in a time of pandemic.

BACKGROUND

Research on body image is abundant, yet much of the literature is deficit-based and focuses on what problems need to be fixed [1]. Many local and international body positive initiatives contain information on what works in relation to helping young women, girls, and non-binary youth feel body positive [2]. As society continues to diversify, it is imperative that modern body positive initiatives accommodate for indigenous, LGBTQ+, and disabled communities [3]. Alongside this, the recent change of climate due to the pandemic has seen a rise of social media usage in young people [4]. This increase coincides with a higher risk of young people being exposed to manipulated images of bodies online which can negatively affect their self-image [5].

AIMS

1. Review literature on what works in community-based body positive initiatives both locally and internationally. The literature should be relevant to indigenous, LGBTQ+, and disabled communities, as well as the pandemic.
2. Produce at least one evidence-based resource for the YWCA that can be used repeatedly in the future.

METHODOLOGY

1. Search for existing body positive initiatives online.
2. Produce a table of these initiatives.
3. Generate a list of evaluations directly related to these initiatives and existing academic research on body positivity.
4. Contact body-positive organisations for extra information on what works.
5. Make a list of possible barriers to engagement with body-positive initiatives.
6. Participate in ongoing dialogue with YWCA about what works.
7. Create a research proposal.
8. Formulate a timeline for project tasks.
9. Produce an evidence-based slideshow, guidebook, and participant handout resource for the YWCA on what research has shown works.

RESULTS

As a result of this research project, a workshop on media literacy was created for the YWCA. Media literacy was chosen as the focus topic due to its prevalence when reviewing the literature on what works in relation to body-positive initiatives. This workshop involves three key resources: a participant handout, slideshow, and workshop leader guidebook. The workshop was made for young girls, women, and non-binary youth aged 10-16. This age group was chosen because it is when young girls and women often start using social media and are exposed to manipulated body images [6].

REFERENCES

Age differences in emotion ratings when reading short stories

Introduction
• Previous research has discovered a positivity bias in older adults for retrieval type tasks, such as a higher chance of recalling positive information, and reappraising memories as being more positive than they were (Devitt & Schacter, 2020).
• One possible account for this result, is that perhaps information is encoded more positively by older adults compared to younger adults.
• We examined whether a positivity bias is observed in a simple encoding task, such as reading statements with various levels of emotional valence.

Research question: How do emotional valence ratings differ between younger and older age groups?

Methodology

Stimuli
- 64 Stories
- 18 details per story
- 6 Positive
- 6 Neutral
- 6 Negative

Participants
- Young (19–35): N = 47
- Old (65–78): N = 48

Procedure
- Each participant randomly presented 4 stories
- Participants rate each detail for emotional valence (1 = very negative, 4 = neutral, 7 = very positive)

Procedure
- Positive detail: You want to set up the tent first, so you look around for a flat patch of ground. Thankfully the tent came with an instruction manual and was easy to set up.
- Negative detail: Once the tent is up, you are not convinced it will last the night.
- Neutral detail: Next you set up your stretcher and place it into the corner of the tent, along with your belongings.

Results

Older adults showed a minor positivity bias in the information encoding task

Figure 1.
Emotional valence ratings by age group and detail type.

<table>
<thead>
<tr>
<th>Detail type</th>
<th>Young</th>
<th>Old</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neutral</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Differences in positive, neutral and negative ratings was significant

No interaction between age group and detail type on scores

Discussion
• Older adults encode information more positively than younger adults.
• This information change during encoding partially explains why positivity bias has been observed in previous memory experiments with older adults.
• There are likely other contributing factors, as the observed difference between young and old adults scores was very small.
• Adding a memory task after the encoding phase would be the next step in understanding the impact encoding has on positivity bias in later memory.

References

This project is funded by a Marsden Fast-Start Grant awarded to A. Devitt [grant number 20-UOW-074].
Te Pae Oranga (TPO) is an alternative justice process for low level offences in partnership with iwi from across Aotearoa and NZ Police. There are currently 20 TPO justice panels across Aotearoa, with more being established.

TPO is guided by tikanga Māori values and allows offenders to take responsibility for their crimes outside of court and prison. Participants must be over 17 years old and willing to engage in a kaupapa Māori approach.

**Research Question**

To what extent does attending Te Pae Oranga improve post-intervention outcomes?

**Methods**

The sample consisted of 2,512 individuals who had been referred to Te Pae Oranga between July 2018 and June 2019. Māori made up 45.6% of the sample, NZ Europeans: 222 and Pasifika 20.7%. Over two thirds (68.8%) identified as male and the mean age was 30.

A control group of individuals not referred to TPO was statistically matched to attendees, so that they could be compared.

Compared to their matched controls, Māori participants had significantly better outcomes than NZ Europeans.

**Core Principles**

- Whakamana: uplifting people, rebuilding their mana
- Whanaungatanga: building connections
- Manaakitanga: kindness, respect and generosity

**RESULTS**

TPO attendees were found to commit significantly fewer offences than their matched controls.

**Discussion**

TPO’s kaupapa of Māori values, education and accountability to prevent crime instead of a punitive approach is effective. The stronger intervention effect for Māori is encouraging and contrasts with some commonly held views.

**Future Research**

- Replication of this study would be useful to determine whether findings are consistent over time.
- Qualitative research should investigate process differences between panels.
- Why does TPO work better for Māori than for Pākehā?
Alessia Spense
Division of Arts, Law, Psychology and Social Sciences

Virtual Reality Evidence in Court

A Virtual Reality (VR) viewing of a crime scene assists juries if the crime scene is destroyed or cannot be visited. But, what are the legal implications of their use?

**Issues**
VR is a direct representation of the underlying data. If scanners of crime scenes are used, jurors will view the original scene. But, testimony might form part of data entry. If the data is not accurate or does not originate from an impartial source, the resultant distortion could be passed off as reality.

**Question**
Which laws, if any, control the admission and use of this persuasive technology in court?

**Method**
Literature review, focusing on New Zealand legislation and evidence law.


**Findings**
The Evidence Act 2006 controls VR admission and use.
1. If admissible, VR must be accompanied by a suitably qualified expert.[3]
2. VR must then meet the substantially helpful test per s 25 of the Evidence Act 2006.
3. Admission is not precluded by s 8, but a jury direction is required. The jury must comprehend the difference between arithmetical measures and subjective (albeit informed) judgements.[4]

Alessia Spense, with supervisors Wayne Rumbles, Fleur Mullen and Richman Wee.
This research was conducted for the Technology in Legal Education New Zealand Project, supported by the New Zealand Law Foundation.

Language Attitudes towards Māori Loanwords in NZE

Public and private methodologies

Introduction

Loanwords, lexical borrowings? Language used in mainstream contexts without actually grasping the entire significance of the word. To New Māori (TRM) has had a recent surge of popularity in New Zealand English (NZE). From news anchors, newspapers and TV shows, the use of Māori words in NZE or Māori loanwords has become somewhat societal norms in recent years. But what do people think about non-Māori using these words? Do non-Māori know the significance of the words they use from Māori in everyday contexts?

This research explored the attitudes and behaviors associated with non-Māori who use Māori loanwords and their attitudes towards others using Māori loanwords as well.

Background research & technical lessons

This research began with an annotated reading list consisting of several different articles focusing on attitudes towards TRM, language attitudes in NZE, and language attitudes in ANZ.

Prior to this I had a one-on-one skills test with Academic Liaison Librarian Anika Farmer-Matoba to improve my ability to research Google Scholar.

Once I gathered enough articles I reviewed each article examining:

- The questions the authors used in their interviews or surveys, and how they formulated their language attitude questions. I then started these in a question bank which I would later use when developing a draft survey.

- Developing the survey: After playing around with Quarrow and reviewing my research, I began to develop a draft of my survey.

- The first bank of questions were related to personal information, such as gender, ethnic background, where people live.

- The second bank of questions were based on personal Māori language information. The purpose of these questions were to get an understanding of the participants’ perception of TRM and their personal use of Māori words and phrases in their daily life. These questions give us insight into their personal beliefs and values associated with TRM.

- The third bank of questions are occupation-specific determining their workplaces attitudes towards TRM.

- The final bank of questions were a series of open-ended questions regarding how they feel about specific Māori topics, and situations, including:

  - How strongly they feel about certain statements
  - What percentage of Māori people are in their life
  - How often they hear specific Māori words, and
  - How often they do the following statements:

Conclusion

ANZ still has a long way to go on its journey to TRM appreciation and understanding. Non-Māori who are unaware of the significance of the Māori words they use on a daily basis in a bigger problem than people believe. It’s the field of everyone in ANZ to restore and sustain the importance of TRM, our language.

Acknowledgements

I would like to express my utmost appreciation to Te Māta Kairangi for this scholarship opportunity in addition to their financial and academic support.

Hei kia kou ana nga rau o whakakāwhia a mai a kia e te konga, e Hei Ho Whangara, e Kimisco Whangara, Koutou dhu ierapita tahi te milk. Kahi e he kura moki high milk massages kia Hui PACUS Researchers Morning Tea Rōto, kia kai kore ana nga rau.
UNDERSTANDING NFTs AND THE LAW

By Ella Shepherd
Supervisors: Wayne Rumbles, Fleur Mullen, Richman Wee

What is Blockchain?
Blockchain is an online network of records that are linked used cryptography. Blockchain facilitates direct trade between individuals without the need for an intermediary party. Blockchain ledgers are append-only, meaning prior transactions or ‘blocks’ cannot be edited or adjusted.

What are NFTs?
NFTs are a non-fungible token. They are unique digital assets than can be exchanged on a blockchain network. NFTs are primarily used for art where the owner has the rights of the authentic and unique piece of digital media. While anyone can have a jpeg of the image, only one person can hold the original.

What’s the Point?
If anyone can use or share a jpeg, what’s the point of a unique NFT? There are three reasons: (1) bragging rights like any other collectable, (2) it’s a way of supporting digital artists, and (3) buying them as investment pieces.

Legal implications
NFTs gain their value from their scarcity. Therefore, NFT sellers need to consider both the Fair Trading Act Act 1986 and the Consumer Guarantees Act 1993 to ensure they are accurately representing the NFT.

Sellers of NFTs should always seek legal advice. As the market is small, sellers should be aware of insider trading practices that would break the Financial Markets Conduct Act 2013.

NFTs are facilitated by smart contracts written into the blockchain. Buyers need to be aware of specific terms written into the smart contract. Furthermore, as NFTs are like any other asset, so buyers should include them in any contracting out agreement under the Property (Relationships) Act 1976 to protect their asset in the event of divorce.

Policy Issue 1: Crime
A digital asset like an NFT can be used to facilitate crime (e.g. selling an NFT in exchange for narcotics). This issue is exacerbated by blockchain networks being anonymous and impossible to reverse.

Policy Issue 2: The Environment
Blockchain requires multiple computers to be constantly updating the shared ledger to work. This uses an incredible amount of power. While there are some methods to reduce the energy consumption, on the whole NFTs are very bad for the environment.

Policy Issue 3: Hacking
Anything can be hacked. Just because blockchain networks are encrypted does not mean that NFTs are safe assets to hold. NFTs are risky investments as cyber technology is always evolving to decrypt the blockchain ledgers.

Example
An NFT of popular YouTube meme ‘Nyan Cat’ (pictured left and in header) was sold for $600,000 USD in 2021.

Example 2
NFT ‘Cryptopunk 3100’ was sold for nearly $12 million USD in 2021.
Shannon Hodge  
Centre for Tertiary Teaching & Learning

**HOW OPEN ARE WE?**  
Waikato Academic Staff Perspectives on Textbooks  
Shannon Hodge  
Supervised by Stephen Harlow (CeTTL)

**BACKGROUND**
This study investigates what influences Waikato academics' choice to use textbooks and how ready they are to adopt Open Textbooks (OTs). OTs are a part of the Open Access movement. By being freely available online they can offer a more equitable approach as every student has access regardless of study mode or financial status [1].

- By investigating current practice in tertiary settings and the impact of COVID-19 lockdowns, this study will assist the Library and CeTTL in supporting academics in making the best textbook choices.

**RESEARCH QUESTIONS**
- How aware are Waikato academic staff of Open Textbooks?
- If so, what are the barriers to adopting Open Textbooks?

**METHODOLOGY**
An online survey was developed using Qualtrics software and promoted to all Waikato academic staff through the staff landing page and email. The survey consists of 39 textbook-related questions, some of which were adapted from a national study on textbooks [2].

- Display logic was utilised to break up questions involving matrix grids to improve the survey response rate.

**ACADEMICS OPEN TO ADOPTING AN OT WITHIN 3 YEARS**

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>37%</td>
<td>63%</td>
</tr>
</tbody>
</table>

**RESULTS**

- 59% of respondents were aware of OTs. Yet, only 1 respondent reported that they prescribed an OT as compulsory.
- When asked if they would use an OT in the next five years, only 37% of respondents said they would consider adopting one.
- Among barriers to adoption, many respondents do not consider OTs to be a suitable quality and lack applicability to the Aotearoa/NZ context.

**WHERE TO NEXT**
The survey will continue to run throughout January. An audit of Waikato Reading Lists will take place, and the data will be submitted to the Open Syllabus project to look for trends with other Universities. Staff that indicated an interest in OTs will be supported to find a suitable OT.

**CONCLUSION**
Most respondents are aware of OTs, but there are prominent barriers to OT adoption, including perceptions of inconsistent quality and applicability to the Aotearoa/NZ context.

**REFERENCES**
Bradley McNamara
Centre for Tertiary Teaching & Learning

Learning from Australasian Examples: Supporting Inclusive Teaching in the Waikato Context
Bradley McNamara, Tracey Morgan and Dr. Alison Jolley
Te Puna Ako - Centre for Tertiary Teaching and Learning

Background:
Inclusive teaching frameworks and practices are vital towards the studying journeys of all staff and students in various Tertiary institutions. However, incorporating these into the lecture theatre and lesson plan can be overwhelming, confusing and inaccessible for many teaching staff. Te Puna Ako Centre for Tertiary Teaching and Learning (CeTTL) at The University of Waikato exists to advise and support inclusive teaching development that staff can use in their teaching practice. To further support this, we asked the following question:

What inclusive teaching resources do Tertiary institutions across Australasia provide?

We have a commitment towards the inclusivity of all students, where they can flourish in their studies and express their identity. Therefore, this project has allowed us to reestablish the foundational framework and improve CeTTL’s future teaching practices.

Key Findings:
- Many Tertiary institutions lack resources surrounding inclusivity.
- Many Tertiary institutions lack success stories of students that have benefited from inclusivity planning and frameworks.
- On average, Australian universities have more examples and resourcing surrounding inclusivity.
- Inclusivity and diversity are often lacking from strategic plans.

Recommendations:
- Tertiary institutions (including the University of Waikato) need to:
  - Improve and extend range of resources surrounding inclusive teaching.
  - Quantify the proportion of the student body that benefit from inclusivity planning and frameworks.
  - Highlight a broader range of examples of where inclusivity has flourished and enriched studying journeys.
  - Improve strategic plans by highlighting the acknowledgment of many inclusive areas. In doing this, an increase in student body may occur.
  - Develop easier modes of access to inclusive and diverse areas on websites.

Acknowledgements:
Bradley would like to thank Tracey Morgan, Dr. Alison Jolley and the CeTTL staff for their continuous guidance and support on this project.

Methods:
- Conducted a content analysis of selected Tertiary websites across Australasia (see background map).
- Reviewed inclusivity hubs (if applicable), strategic plans, and teaching frameworks.
- Collate key information drawn from key inclusivity areas on Tertiary websites.
- Document observations via the use of a spreadsheet.
- Tally points where inclusivity was mentioned/acknowledged.
- Visually compare inclusivity averages (Figure 2).

Figure 2: Word cloud created with key words/terms from the University of Waikato’s Accessibility Services video.
https://www.youtube.com/watch?v=YI1cE2hVx-s
The video highlights how students from diverse backgrounds have been supported with their studies.

“...an environment of inclusion as the cultural glue of the University.”
Deakin University, Australia.

Figure 2: Australia, Aotearoa and Waikato averages across specific areas of inclusivity (based on their presence/absence on each website).
two year-olds too young to groove?
fergus byett (supervised by dr. bronya dean & dr. rebecca evans)

music groups?
• half of 2-year-olds attended music groups
• no association with gender
• first-born children were more likely to attend
• attendance associated with higher maternal education & greater household income
• european families more likely to attend than māori, asian & pasifika families

what are the musical experiences of kiwi toddlers in the 21st century?

concerts?
• 1% of 2-year-olds had attended a 'concert'
• higher attendance of cultural events e.g., polyfest (7%)
• no association with gender, ethnicity, parity, rurality, or frequency of maternal singing at 9 months

instruments?
• 31% of 2-year-olds played with instruments once a day or more
• first-born children played with them more frequently
• no association with child gender
• frequent instrumental play associated with a high freq. of maternal singing at 9 months

recorded music?
• 69% of 2-year-olds used devices to listen to music on a typical day
• 51% listened for an hour or more

[2] ‘Music notes: Flaticon.com’. This poster has been designed using resources from Flaticon.com
Embedding Computational Thinking into Authentic Technology Practice

By: Swati Gulati
Supervisors: Dr Wendy Fox Turnbull & Dr Shaoqun Wu

“Those who are not involved in programming will become programmed”
Rushkoff (2010)

What was done?
A systematic research was conducted to develop an annotated bibliography in the fields of digital technologies, computational thinking and how different aspects of robotics and game design can enhance the skills of the primary students and most importantly the indigenous learners.

Background
- Jeanette Wing (2006) advocated computational thinking as a primary skill along reading, writing & arithmetic.
- Computational thinking is labelled as the 21st century literacy since it allows non-computers scientists to benefit from a computational approach to problem-solving (Mahsa Mohagheh, 2016).
- The Ministry of Education, New Zealand are encouraging integration of coding with the curriculum to respond to the shortage of skilled professionals engaging in high-tech and supposedly high economic value work.

Recommendations
- Culturally responsive design of computational thinking tools is required to build inclusive community cultures.
- Efforts to make visual programming tools culturally responsive include making changes to surface features such as content or element names, context the tool is presented in, and the design of the computing activities themselves.

“Games are inherently artifacts of culture through which cultural roles, values, and knowledge bases are transmitted”
(Nasir 2005)
‘That is me’: The Power of Pacific Picturebooks
Angela Fuimaono
Supervisors: Janette Kelly-Ware and Nicola Daly

Vignette One
‘That is me’
The children were playing cornhole, but one child did not want to play. She was more interested in showing me books from the Kindergarten bookshelf.

This quiet 3-year-old girl with curly brown hair and bright brown eyes brought me a book depicting a young Pacific Island girl who was preparing to start school. The book was created in New Zealand by a kindergarten organisation who recognised the lack of culturally authentic books for Pacific students and so created their own.

[Whanau Manaaki Kindergarten, 2020]

The girl confidently stated, “That is me”, while pointing at the smiling girl with curly brown hair on the front cover. She could see herself reflected in the imagery and main protagonist. Afterwards she gently placed the book back on the shelf. This vignette shows a child recognising and identifying themself with the cover image of a picturebook. This links to Tapasā, Turu 1, which discusses the importance of identities, languages and cultures in educating Pacific children (MoE 2010).

Almost a third of students in New Zealand are Pacific or Māori, yet picturebooks available are still predominantly European/English language (Long, 2010).

Research Question
How do children and teachers respond to Pacific Picturebooks?

Methods
• Qualitative pilot study conducted at a kindergarten which caters to predominantly Pacific families and is run by Pacific teachers.
• 10 Pacific picturebooks were chosen and sourced for teachers to read to the children.
• Talanoa (meaningful conversations) were held to discuss research goals with teachers.
• Observations were made of children’s and teacher’s responses to picturebooks.

Early Thoughts and Recommendations
• Culturally authentic books can be effective in creating connections to language, culture and identity for children.
• Teachers can use Pacific picturebooks to connect with and develop children’s funds of knowledge and cultural capital.

The pilot project taught us:
• The need to engage with ‘Teu le va’, culturally responsive research practices.
• The importance, and difficulty of locating culturally authentic Pacific picturebooks.

Vignette Two
Making a fale
The children and teacher were outside on a mat on the grass. The teacher started reading ‘Kaiana and Teiti’ which is a story about a child who goes overseas to visit her family. Halfway through the story the children became focused on the fale featured in the picturebook. They then eagerly spent a large amount of time with their teacher, creating their own fale from recycled items found around the kindergarten.

(David Ling Publishing Limited, 2020)

After they had worked together to construct their fale the teacher reintroduced the book by reading the final pages to the children while they sat inside their fale.

In this vignette, the teacher was able to engage children in the story and use culturally responsive pedagogy to make connections between the children’s own cultural knowledge and the imagery and words within the book. The curriculum emerged from the picturebook and shows children making connections between people, places and things (Te waihanga hononga) (MoE, 2017).

Fa’afetai Lava to Tai o Fenua Kindergarten for sharing their knowledge with us.

Scan to see Waikato Picturebook Research Unit
Rationale:
The focus of this research project is to understand the experiences of first-year Bachelor of Teaching (B.Tch) Mixed-Media Teacher Education Programme (MMP) student teachers who are, or have been employed as teacher-aides, as they transition from, and often between, their roles as teacher aide/student teacher.

Within New Zealand, 17,859 people identified as being employed as teacher aides (Stats NZ, 2019). There is no official record of how many teacher aides enroll in B.Tch degrees available in New Zealand. Anecdotally, the University of Waikato B.Tch (MMP) attracts a number of students with current or past teacher-aide experience. Teacher aide roles are “moving closer to a classroom teacher’s role, but often without clarity of boundaries” (Martin, 2021, p. 566) and as such we believe it is important to understand the skills, experiences and responsibilities teacher aides bring to their role as student teachers.

Additionally, while there is emerging research focusing on the barriers and enablers students experience as they begin their tertiary studies, little is known about the issues, barriers and/or enablers student-teachers may experience as they transition from and often between, their role as a teacher aide to a student teacher on their W.I.L. days.

My personal interest in the project stems from my 14+ years as a teacher aide and the knowledge and experiences I held prior to entering the B.Tch M.M.P programme. I believe my experiences strengthened my developing student teacher identity. I have faced both challenges and successes in my work integrated learning (W.I.L.) as a result of drawing on my teacher aide skills and experiences. I will draw on these personal experiences to understand the information provided by the research participants and to make connections with literature.

Methodology:
- Applied to Division of Education ethics committee
- Dr. Cook invited eligible students to complete survey
- Analysed survey information of 9 participants
- Grouped common themes

Findings:
The findings indicate that New Zealand teacher aides roles are broad and encompass a range of tasks within the classroom and wider school environment. Vogt et al (2021) acknowledges schools growing reliance on teacher aides to fulfill teaching roles rather than supporting the class as a whole, although he cautions “teacher-aides should provide administrative and organisational support, but that they should not take on instruction, as they are not qualified” (p.216). This contradicts a number of specialised roles participants fulfilled within their schools, such as setting up specialised programmes, planning their own lessons, delivering teacher lessons, and administering medical care. It is evident that teacher aide roles can be unstructured, requiring a high degree of adaptability, and expectations of teacher-aides can vary from school to school.

Participants, while acknowledging the various barriers and enablers they experienced over their first year, were unable to identify any specific moment where they noticed a change in their identity from teacher-aide to student teacher. MacFarlane (2018) believes “learner identity [such as being a student teacher] is a temporary state which is socially constructed and it is a complex longitudinal process” (p.1202). Reflecting on their first year of study, participants attributed their emerging identity as a student teacher, to their developing confidence in their professional skills, such as teaching, classroom and behaviour management, and a deeper respect from students.

Conclusion:
Teacher aide roles vary according to individual school needs and the experience and skills of the individual teacher-aide. Thus, teacher-aides enrolling in the Bachelor of Teaching (MMP) bring a vast range of practical knowledge to their student teacher role. The difficulty is accurately determining the level of individual student’s knowledge, skills and experience, when within any particular intake of students, the range of school-based work experience expands from no experience to 15+ years of teacher-aide experience. This poses challenges for tertiary staff on how they might acknowledge and draw upon students prior experiences.

Further research into student development of their teacher identity is needed and Dr Cook is planning a longitudinal study that will follow students across the three years of their degree.
Nicola Paul

Historically, sexual education in Aotearoa New Zealand has failed to acknowledge the existence of rainbow/LGBTQIA+ people (Ellis & Bentham, 2021). This means that most rangatahi are turning to the internet for their sexual education. Our study analyses 5 popular sexual education websites (Family Planning, Get the facts AU, Planned Parenthood, Just the Facts and the NHS) in a range of different areas to determine how inclusive they are.

Two primary research questions were investigated: (a) To what extent did each of these websites cover our three themes; biological sexual health (STI and pregnancy prevention, fertility options, etc), sexual identities and relationships and possible adverse outcomes in relation to sexual health (sexual violence and/or coercion, peer pressure to have sex and/or start dating, etc)? And (b) What additional sexual health and sexuality topics are covered on these websites? We used a qualitative method called content analysis where we took paragraphs from these websites that were of interest and critiqued them.

Overall our websites comprehensively cover biological sexual health and the possible adverse outcomes in relation to sexual health. Yet, they fail to adequately cover topics around sexual identities and relationships. Some examples of these topics were:

- Safe sex in lesbian relationships.
- How to navigate non-monogamous sex and relationships in a safe manner.
- Sex as a fun and pleasurable activity.

Acknowledgements

I would like to thank my supervisor Dr Sonja Ellis for her guidance and the University of Waikato Summer Research Scholarship program for giving me this amazing opportunity.

References

**Learning and Living at Te Whare Wānanga o Waikato the University of Waikato – A Disabled Person’s Experience**

**Supervisors:** Associate Professor Patsie Frawley and Professor Claire Breen  
**Participant Researcher:** Nikita Van Dijk

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**Intro**

Access and inclusion of the disabled community at the University of Waikato has always been an issue, and so this project was used to understand and highlight the experiences of disabled individuals and the issues they face.

**Relevant Laws and Policies**

There are many laws and policies protecting disabled individuals in regards to access, inclusion and education, such as:

- Section 19 of the NZ Bill of Rights (right to freedom from discrimination)
- Section 21 of the NZ Human Rights Act (disability became a prohibited grounds for discrimination)
- Multiple articles of the United Nations Convention on the Rights of Persons with Disabilities (education - 24, access - 09, protection from discrimination - 05)
- Policies from the NZODI (accessible learning pathways, Disability Action Plan)
- The Kia Orite Toolkit - outlines the Code of Practice to achieve an inclusive and equitable tertiary education environment for disabled learners

Education and Training Act (law that informs disability strategies in regards to access to education)

It is through the lens of these laws and policies that the data for this project was analysed.

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**Method**

To best understand the experiences and issues that the disabled community face at the University of Waikato, interviews were conducted with disabled students. The first interview focused on their experiences across the board (physical access and inclusion, online access and inclusion, staff and student support, etc) and the second focused on anything else they wanted to add and how they wanted their stories to be told. A rapid review of laws and legislation was always undertaken so that the data could accurately be put into context.

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**Results**

**Physical Access Issues**

Lecture theatres are inaccessible for students, the buildings are deteriorating, maintenance takes too long to respond to complaints - ‘accessibility is an afterthought rather than a priority’ (Participant #02), ‘the only elevators that appear to regularly work are the ones in the library’ (Participant #03).

Lack of Awareness and Understanding From Staff

Lack of consistent support from staff across the faculties and the executive of the University - ‘lecturers choosing to not be understanding of disability…leads to having to challenge decisions and conversations…it’s exhausting’ (Participant #04), ‘Lecturers fighting again adaptation that [I] was entitled to…and privacy issues (related to this)’ (Participant #05).

Online Learning

Moodle is outdated, and has no accessibility options, however very supportive staff.

Accessibility Services

Incredible at advocating and getting support for students, despite their hands being tied - ‘One of the best experiences was being able to access another room to take tests’ (Participant #05).

Above: The route from WSU to TT and TC that participants with mobility issues are expected to make in ten minutes. This is half a kilometre.

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**"The decrepit nature of campus (Hamilton) makes accessing education a challenge…. Elevators constantly out, and light fixtures that set off flares so bad that I vomit” - Participant #01**

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**What Can We Do?**

Addressing and fixing these issues are not optional extras. These are legal requirements.
Maryam Al-Hajri  
Division of Health, Engineering, Computing and Science

Development of Novel Microstructures for Titanium Alloy

Maryam Al-Hajri  
Supervisor: Ajit Pal Singh

Abstract
The research aims to develop the microstructure for the extruded Ti64 through heat treatments. Three samples were prepared, each sample was treated differently. The first sample is Ti64 as extruded. The second is Ti64 were heated up to 955°C and by the surrounding, while the third sample is heated up to 925°C and cooled slowly for 50°C/h. However, after the heat treatment was done, a series of tests were done. And was found that the sample of 925°C heat treatment is giving a high strength metal (949MPa) and the ductility is developed compared with extruded Ti64, while sample 955°C is less in strength but is tougher.

Experimental Method
1. Block Ti64
   - Block material of 90% wt Ti, 6% wt Al and 4% wt V
2. Heat Treatment
   - Vacuum Sintering Furnace
   - Sample 1: As extruded Ti64
   - Sample 2: 955°C, cooled by the furnace
   - Sample 3: 925°C, cooled 50°C/h
3. Wire EDM
   - Cutting the samples for testing
4. Tensile Testing
   - Intron Tensile Tester
5. XRD
   - Fracture surface analysis
   - Making Judgment
   - Magnifications 100X, 200X, 500X, 1000X
6. Hardness Test
   - Vicker’s Hardness Tester
7. SEM
   - Fracture surface was showing dimples and flat fracture.
   - Fine beta lines, and thick alpha lines.
   - Grain size 50-150 micrometers.
   - Many colonies of lamellar within one grain.
   - Larger grains size (approx 200 micrometers).
   - Thick lamellar beta, alpha shrank.
   - Surface crack, dimples are represented along the surface fracture.
8. SEM
   - Grain size 50-150 micrometers.
   - None continues beta lines and very thine lines. Alpha is bigger in size (2 micrometers).

Result
SEM
- As Extruded
  - Fracture surface was showing dimples and flat fracture.
  - Fine beta lines, and thick alpha lines.
  - Grain size 50-150 micrometers.
  - Many colonies of lamellar within one grain.
- 955°C HT
  - Larger grains size (approx 200 micrometers).
  - Thick lamellar beta, alpha shrank.
  - Surface crack, dimples are represented along the surface fracture.
- 925°C HT
  - Grain size 50-150 micrometers.
  - None continues beta lines and very thine lines. Alpha is bigger in size (2 micrometers).

Tensile Test
From the tensile test, it’s clear that the heat treatment has developed the mechanical properties of Ti64 compared with as extruded specimen.

Hardness Test
Decrease in hardness due to the change of microstructures during the heat treatment process. The different process has to give different grains size and different microstructures, which has resulted in different values of hardness.

XRD
- The graph identifies the phase that is represented within the material under study. As the highest peak represents titanium (beta phase).

Conclusion
In conclusion, the heat treatment has improved the microstructures of Ti64. As both samples of 955°C and 925°C, the microstructures have changed compared with the original microstructure, but each sample has shown different microstructures due to the difference in the heating process such as temperature, cooling rate, and holding time. The temperature is controlling the grain growth and cooling rate controls the thickness of beta lines. A slow cooling rate of Ti64 will give smaller grain size and thin beta line thickness, while fast cooling rate has give bigger small size of Ti64 and thicker beta line. Thus, the heat treatment sample was tougher and more ductile, and of sample 925°C have more strength due to small grains size.

Acknowledgment
Thank you to my supervisor, Dr. Ajit Pal Singh, for his patience, guidance, and support. I have benefited greatly from his wealth of knowledge and experience. I am extremely grateful that he has taken me on as a student intern in his summer research.
Iron (Fe) is a fairly common and cheap metal that is abundant on earth. Fe is widely used throughout daily life, as well as in different industries. Due to the mechanical properties of Fe, such as relatively high strength and ductility, it is commonly used as an alloying element in the industry. Copper (Cu) is another common alloying element due to its low cost, availability and ability to improve the properties of alloys. Cu can have a significant effect of the mechanical performance of the alloy. Such as, increasing the toughness and density. Immiscibility alloys are characterized with a miscibility gap in the liquid state, which exhibit a liquid-liquid phase separation during solidification. which results in the liquid-phase separation between the Fe and Cu during the solidification phase. This results in the Cu phase existing separately from the Fe matrix for the Fe-Cu system, and Fe phase existing separately from the Cu matrix for the Cu-Fe system.

**OBJECTIVE**

**THE AIM IS THE PRODUCTION OF Fe-xCu ALLOYS AND Cu-xFe ALLOYS VIA POWDER METALLURGY BY HOT PRESSING UNDER ARGON ATMOSPHERE.**

**EXPERIMENTAL**

<table>
<thead>
<tr>
<th>Process</th>
<th>Metal Powders</th>
<th>Powder Mixing</th>
<th>Warm Pressing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Green Compact</strong></td>
<td>Green</td>
<td>Hot</td>
<td>Sintered</td>
</tr>
<tr>
<td><strong>Hot Pressing</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sintered Compact</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**RESULTS**

**MECHANICAL PROPERTIES**

The alloys experience an increase in green density. Which is the ratio of metallic powder to the volume of the compact after warm pressing. As for the sintered density, the general trend is a decrease excluding the pure metals.

The alloys are decreasing in the sintered density due to the increase in overall ductility brought in by the increase in Cu metal.

The alloys display a decrease in hardness with the increase in Cu, which is due to the relative increase in ductility.

**ACKNOWLEDGMENTS**

I would like to thank the University of Waikato Summer Research Scholarship Programme for the opportunity and would also like to thank Dr. Leandro Bolzoni for his guidance and help throughout the summer internship programme.

**CONCLUSION**

In conclusion, the aim of the research was to determine the mechanical properties of Fe-based and Cu-based alloys and examine the microstructure. The results show that the alloys follow a trend, with the increase of Cu, the yield strength (YS), ultimate tensile strength (UTS), and the elongation decrease, as well as the hardness. The green density increased while the sintered density decreased.

The relative decrease in sintered density was due to the fact that the porosity levels in the microstructure of the alloys increases with the increase in Cu content till pure Cu. The visibility of the aforementioned spherical pores are a sign the alloys have reached the third sintering stage. As the pore become isolated and grow, larger pores tend to grow due to Ostwald ripening, which lead to the decreases in density. As can also be seen the clear separation between the two metals, with Cu resembling an orange/pink color, while Fe resembling a blue color.
Unlocking Umami Taste Modifiers in Sea Lettuce Broth

Background

Functionality
Umami tastants and enhancers are used to improve palatability, enhance savoury flavours and increase salt perception. MSG can substitute up to 50% of NaCl with 30% less sodium by weight. [1]

The sodium salts of aspartic and glutamic acids have an umami taste. These tastants bind to orthosteric sites on taste receptors.

The S'-isomers of ribonucleotides (IMP, GMP and AMP) and peptides with L-Asp and L-Glu residues stabilise taste perception, intensifying umami taste. [2]

Since the first extraction of monosodium glutamate (MSG) from seaweed, commercial production of umami-tasting compounds has evolved to targeted fermentation.

1908 Discovery of MSG in kombu
1955 MSG extraction
1957 First umami peptide discovered
1971 "Chinese Restaurant Syndrome" reported
1968 "Chinese Restaurant Syndrome" reported
1961-1973 Chemical synthesis
1978 Enzymatic pre-treatment

Further Steps

Pending amino acid and nucleotide assay results

Flavour profiling
Volatile composition: GC-MS
Sensory analysis

Optimisation
Central composite design
Microorganism growth studies

References


Experimental Design

Four factor, two level full factorial design. Replicates of Ulva ralfsii (substrate), collected over three consecutive harvests.

Multivariate analysis of umami compound assays. Comparison of equivalent umami concentrations from nucleotide and amino acid concentrations, determined via HPLC in duplicate.

To see more:
Pending amino acid and nucleotide assay results

Food

Yeast extract
Parmesan
Sardines
Broccoli

MSG content (mg/100g)
1753
1200
280
176

References
Discovering antibody target identity
Marina K. Barcellos, Dr. Gregory Jacobson & Dr. William Kelton
Te Huataki Waiora School of Health

Introduction
Antibodies are protein molecules that play an essential role in the immune system by fighting pathogens. They are quite resistant to heat-induced denaturation\(^1\), and thus we hypothesise that the proteins that antibodies bind to will have improved stability. Based on our hypothesis, we can use this shift in stability to determine what the target of an antibody of interest is, such as in cases of autoimmune disease.

Methods
- Adapted from previous Cellular Thermal Shift Assays \(^2, 3\)
- Each pair of samples was exposed to a different temperature
- Between 55°C and 85°C
- Western Blot to visualise the results

Results

<table>
<thead>
<tr>
<th>Unfolding temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>HER2 protein</td>
</tr>
<tr>
<td>Antibody Herceptin</td>
</tr>
</tbody>
</table>

As temperature increases, unbound proteins aggregate more, and there is less HER2 for the Anti-His HRP to bind to when compared to samples with proteins bound to antibodies.

Conclusion
- Proteins bound to antibodies are more thermally stable
- The shift in stability is more observable at 73°C or higher
- In future, we will test the antibody thermal assay with intact cells

Significance: antibody thermal assay could potentially be used to discover the target of antibodies of interest in people with autoimmune diseases.

References:
Otitis Media in General Practice

Authored by Andre Becker, Andrew Wood, Senior Lecturer of Surgery at University of Auckland, Ross Lawrenson, Professor of Population Health at University of Waikato

Introduction

Acute otitis media (AOM) (inflammation of the middle ear) is a common condition in children. It can become chronic and lead to effusion in the middle ear (Otitis Media with effusion or OME), hearing loss and developmental delay. Some children will benefit from the surgical insertion of tympanostomy tubes (grommets) through the ear drum which help drain any effusion and restore hearing. About 300 grommet operations a year are carried out each year at Waikato hospital.

This study was conducted to investigate whether children who met the criteria for grommets were being referred to specialist care, and if there were any barriers to these patients receiving specialist care. We especially wanted to see if there was equitable access for Māori compared to NZ European patients.

Results

There were 1098 patients who met the criteria seen in this period at Ōtorohanga Medical Centre, 48% of which were European/Pākehā NZ patients and 618 Māori. In both groups, the distribution of socioeconomic deprivation tended towards higher deprivation. In the European/Pākehā group this peaked at 3-4, whereas the Māori group peaked at 4-5. This trend in the Māori quintile distribution followed the national trend of greater deprivation, whereas the European/Pākehā quintile distribution is higher than expected (ref: NZDep2013).

In 2019, European and Māori showed similar incidence of AOM of ~20%. In 2020 and 2021, incidence of AOM halved. The incidence of OME in Māori was slightly less. In age groups 2-5 in 2019, the incidence of OM was ~31%, consistent with other studies.

Antibiotics were prescribed to 80% in patients visiting with OM.

20 patients received grommet surgery from 2019 to 2021: 9 were European/Pākehā, 11 were Māori. 8 were in 2019, 7 in 2020 and 5 in 2021. The average age for receiving grommets was lower in European/Pākehā (4.9 years) compared to Māori (6.1).

Method

The study population was children aged 1-14 who attended Ōtorohanga Medical Centre for any reason who had a primary ethnicity of either European/Pakeha or Māori over the period of January 2019 to December 2021.

European/Pakeha patients with a secondary ethnicity of Māori were considered Māori for the purpose of stratification (13 out of 1098 patients)

The Medtech32 database was used to review patients’ Daily Record forevidence of AOM and OME in accordance with accepted diagnostic criteria. (ref: bpacNZ) Signs of inflammation of the tympanic membraanelisted in patient notes without evidence of otitis externawere recorded as AOM. Presence of fluid behind the tympanic membrane was recorded as OME.

Patients’ Daily record, Inbox and Outbox were reviewed for referral to ENT specialists and audiometry, as well as evidence of surgical intervention in the form of grommets.

Discussion

AOM is still a common condition with 30% of children under 5 presenting during 2019. The incidence halved in the years of 2020 and 2021, likely due to reduced respiratory infections in children associated with Covid lockdowns.

Antibiotic prescription remained higher than suggested by guidelines. The main reason for this appeared to be parents desire for medication when seeing a GP. Only 5-8 children per 1000 per year received a grommet operation during the study time period.

We did not show any major differences between Māori and NZ European children. Māori were slightly less likely to present with AOM and were older than NZ European when receiving grommets.

In conclusion, while AOM is common, OME is relatively rare, but access to grommet surgery is still needed by a small number of children.
The initial brief for this project included assessing current tools & processors for whether and where AI/ML could be applied within and/or across Gallagher’s products & services, along with what capabilities would be required for deploying AI/ML technologies.

**BACKGROUND**

Gallagher Group created an Analytics & Insights team, more than two years ago, to drive data-driven decisions in all areas of its business and is progressing with company-wide digital literacy trainings and modern workplace initiatives. Their aim is to be more agile and completely data-driven with AI/ML being a natural progression to this. Therefore, prioritizing relevant AI/ML initiatives that can help drive strategic company objectives is important, with AI/ML becoming more and more a competitive advantage in nearly all industries.

**PROJECT OBJECTIVES**

To source broadly and determine within Gallagher from interviews with key stakeholders, relevant AI/ML use-cases for every department; in which each use-case can be validated, analysed, and evaluated for its potential priority following a specific process and formula. This is then mapped onto a 4 quadrant matrix.

Each potential use-case is validated, analysed and evaluated for its potential priority following a specific process and formula. This is then mapped onto a 4 quadrant matrix.

**PRIORITIZATION FRAMEWORK**

1. **Refine:** The framework was designed so that it can be used within Gallagher’s current systems and processors, as they already manage their IT projects with a portfolio approach. Using a prioritized portfolio approach for AI/ML initiatives can be beneficial as well as transformative for companies like Gallagher Group. Please scan the QR code to follow the journey.

2. **Validate:** The following use-cases were prioritized: 1, 7 & 21 for Big Bets. 4, 10 & 12 for Quick Wins. 5, 13 & 14 for Incremental. If you follow the QR code on this poster, you will be taken to advice on best practice, research and recommendations for leveraging these opportunities and similar ones in other industries.

3. **Analyze:**

4. **Evaluate:**

5. **Prioritize:**

**IMPlications & Conclusion**

NOTE: This is treated as a continual process and similar to a MVP, where it can be experimented with and improved over-time and possibly applied to other IT projects.

Acknowledgements: I would like to thank everyone in the AI team and especially my manager Tarun Kumar as well as the MOA Lab at UoW and my supervisor Dr Heitor Gomes.

INTRODUCTION

A new generation of young kiwis are promoting beach safety to individuals and their community by becoming Surf Lifeguards. Kiwis as young as fourteen can become Lifeguards, therefore it is important that volunteers are appropriately trained for the unpredictable beach environment. Younger generations tend to be more tech savvy and embrace new forms of information consumption. This app is intended to be used as an alternative to physical material. My research consists of exploring new methods to present and navigate information in time critical situations on mobile.

KEY CONSIDERATIONS

Every design decision needed to center the user and their necessity to find information as quickly as possible. The app needed to be visually simple, yet intuitive and easy to understand. Key visual considerations such as:

- Typography - Size, font, weight. Hierarchy for most important information. Easy to read from a distance.
- Size of User Interface Elements - Eliminate undesired input. Sufficient spacing between elements
- Navigation - Find First Aid topics as quickly as possible. Limit the number of options shown.

Displays a list for each First Aid presentation. Ordered by commonality. A limit of six items is shown on screen at a time, uses scroll freely. Users can search directly.

Hyper scroll allows the user to go through the whole list quickly by viewing one item at a time in a static position. The scrollbar is held down while moving vertically to traverse the list.

Each screen has the necessary First Aid steps to take. Conditional statements are used to reduce reading. The user can go back to a given step at any time.

‘Priorities’, ‘Do’ and ‘Think’ are related information. Reflections and possible causes are included to assist with potential future incidents.

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*First Aid content written by Medical Professionals at Surf Life Saving New Zealand
Investigation of methane emissions from a grazed turnip pasture

Lee Boon
Supervised by Jordan Goodrich

Introduction / Background

- The concentration of methane (CH$_4$) has nearly tripled since pre-industrial times, contributing substantially to climate change$^1$.
- CH$_4$ sources include natural wetlands, factories, rice cultivation and ruminant animals$^2$.
- Upland mineral soils are typically found to consume atmospheric methane, but emerging debate in the literature suggests agricultural soils may act as a source$^3,4$.

Aim

- The aim of this project was to measure CH$_4$ flux from a grazed turnip pasture on a dairy farm to determine whether the soil was a source or sink, and characterize the spatial and temporal variability.

Method

- 24 chamber collars were installed in the ground and the fitted chamber tops sealed during measurements to track gas exchange into and out of the soil.
- Using a syringe, an air sample was extracted from the chamber and injected into an evacuated vial every 20 min over a 60 min sampling period.
- Gas samples were analyzed using a quantum cascade laser spectrometer to identify CH$_4$ concentration. CH$_4$ flux was then calculated as the slope in concentration over time.

Results

Figure 1: The CH$_4$ flux from each day of sampling over the grazed turnip paddock, from 10/01/22 to 13/01/22. Over the 4 days, 91 samples were analysed from 12 chambers over the grazed turnip pasture.

Figure 2: The CH$_4$ flux from each chamber over the grazed turnip paddock. Each chamber was sampled 4 times over the 60 min sampling period, 4 days in a row (10/01/22 to 13/01/22). The different colour hues represent the chambers that were paired together over the site.

Conclusion

- The soil acted as both a small source and a sink of CH$_4$ across the different days (Figure 1).
- Differences in fluxes among chambers (Figure 2) suggests that is less likely to be driven by soil temperature and moisture as expected, but rather by hot-spots of CH$_4$ on the pasture$^5$ (e.g. possibly influenced by cow excrement varying spatially over the sampling days).
- Chambers 16 and 17 consistently showed a negative flux, whereas chamber 20 had a greater spread of CH$_4$ fluxes over the 4 days of sampling, demonstrating the importance of capturing the strong heterogeneity of CH$_4$ uptake or emissions across the site.

Future work

- Further sampling will capture a longer time series of CH$_4$ fluxes, including recent rain events, and allow comparison against CH$_4$ fluxes at an adjacent pasture and un-grazed turnip site.
- Fluxes of CH$_4$ will be combined with CO$_2$ and N$_2$O to determine a greenhouse gas budget for the site.

References

1. Ed Dlugokencky, NOAA/GML (gml.noaa.gov/ccgg/trends_ch4/)
A Warming Climate

WHAT DOES THIS MEAN FOR OUR COASTS?

Background

Temperatures have one of the greatest influences on energy demand and metabolic activity. It has been predicted that with warming temperatures there will be a depletion of carbon from carbon sinks like intertidal sediments through increased community activity [1]. Supported by terrestrial soil studies which have predicted that due to reduced P:R ratios that terrestrial stores could deplete up to 50% in the next two decades [2]. Through the application of Macromolecular rate theory curves which combines both abiotic and biotic responses to increases in temperatures, it is possible to identify the tipping point where respiration will exceed photosynthesis in a given soil [3].

Aim: Investigate the effect of increased ambient thermal temperatures on the respiration curves within intertidal sediment and their proximity to the tipping points using MMRT

Methodology

- pH porewater analysis post incubation
- Heat block incubation of 2g of sample (10-50°C)
- IRGA CO2 measurement (1ml)
- Addition of Glucose solutions (0.25ml)

Discussion

From the data presented on figure 2 it is visible that regardless of whether the full range of temperatures are not reached that there will be a depletion of carbon from stores within the intertidal sediments from the sampled sites.

From the two top figures all but the Thames sample demonstrate the MMRT curve, however its individual measurements follow similar trends to the other 6 sites.

The Glucose treatment highlights the impact that additional anthropogenic stressors could have with the presence of added thermal stress.

The light-dark plot indicates the presence of a significant difference between true respiration (dark) and the effect of photosynthesis on the system.

However, there is not enough evidence yet to indicate whether there is significant decoupling occurring between light and dark like there is in terrestrial samples at elevated temperatures.

Temperature will have a large effect on intertidal sediments with medium to high organic material content.

Increased nutrient loads in the water reduce the temperature at which the tipping point is reached.

Light-dark incubations demonstrate the tipping point temperatures for marine sediment.

Reducing the anthropogenic stressors is an option to mitigate the effect of climate change on marine sediment.

Results

Figure 2: The figures above display the 4 main variations in trials for this experiment which were repeated. The top two illustrate 6 different sampling locations from the BOP coastline from the Coromandel to Whakatane. The bottom two display the effect of light-dark incubations and the effect of glucose being added to Mayfair soil samples.

Carbon Transfer

- Primary producers introduce nutrients into systems for warming cycles.
- Consumers introduce gain into the increase of these nutrients.
- Filter & suspension feeders introduce nutrients into the sediments microbial community releasing CO2.

Conclusion

- Temperature will have a large effect on intertidal sediments with medium to high organic material content.
- Increased nutrient loads in the water reduce the temperature at which the tipping point is reached.
- Light-dark incubations demonstrate the tipping point temperatures for marine sediment.
- Reducing the anthropogenic stressors is an option to mitigate the effect of climate change on marine sediment.

References

Introduction

What headings create the best hierarchy? Timpany’s (2018) studies show that people rank headings in order of importance: bold, size, sans-serif, capitalisation, spacing, and italics. But what about when there is a main heading, subheading, and tertiary heading? This project contributes to ongoing research of documents with multiple levels of headings, and discovering what variables most effectively convey hierarchy relationships between heading levels in a text document.

For example, an ideal main heading may include bold, sans-serif, and size, while a subheading would work best with just bold and sans-serif, and a tertiary heading may include sans-serif and italics.

Preliminary Findings

Participant studies are currently ongoing, but so far they indicate that size is one of the biggest factors in determining the order of headings. For some users, however, the removal of bold can often disrupt them from ordering by size alone. It shows that bold is also a very important variable when it comes to headings. Preliminary testing also suggests that increasing the number of typographic variables in a heading greatly increases the amount of importance that a user assigns to it. The opposite effect occurs when italics is used in a heading. This variable seems to detract from the importance of a heading.
A Proposed Machine Learning and Metaheuristic-Aided Approach to Automated System Configuration

Introduction
Over the years, the complexity of IT systems has grown, and with it the challenge of configuring each component within a system to meet quality-of-service (QoS) objectives. While expertise is often employed when configuring these systems, human error is still a present factor and can lead to inefficient or even vulnerable system configurations. Automation is also difficult, as an exhaustive search to find the most optimal configuration can be quite computationally expensive.

This project looks to examine the use of machine learning techniques to intelligently and automatically perform online system configuration for computer network components.

Aims
This research aims to:
- Examine literature detailing recent approaches to automated system configuration
- Investigate an appropriate search algorithm for selecting an optimal or near-optimal configuration solution
- Produce a formulation of a possible approach to automated system configuration

Outcomes
Optimizing system autoconfiguration setup
Pareto Simulated Annealing
PSA is a metaheuristic algorithm introduced by Czyżak & Jaskiewicz (1998) [1] that is useful for solving multi-objective combinatorial optimization problems. It is based on the single-objective Simulated Annealing method which uses a process inspired by metallurgy to move an initially random solution toward a global optimum while escaping local optima by accepting non-improving solutions with an ever-decreasing probability.

For a multi-objective problem, this algorithm uses a set of interacting solutions, each of which are optimized using different “weights” on each of the different objectives, approximating what is known as a “pareto optimal front”, or a set of solutions which are optimal at different weightings of the objectives.

References:

Conclusions
- Literature has been reviewed to examine proposed solutions to the problem of automated system configuration.
- Pareto Simulated Annealing has been identified as a suitable multi-objective optimization algorithm.
- Predictive machine learning has been identified as a performance evaluation method instead of live-system experiments.
- A potential setup for system autoconfiguration has been proposed.

Future steps
- Implementation and testing of the proposed pipeline on a real-world system.
- A dataset will need to be generated for training and validating the predictive algorithms.
- Experimentation needed to select appropriate regression models (RandomForest, SVM, etc.) and PSA parameters.
- Investigation needed to select a decision-making scheme for final configuration selection.

Acknowledgements:
I wish to give thanks to Victoria Huang for offering me this project, Dr. Kumar and the CROW group for their support and supervision, and the University of Waikato Summer Research programme for providing this opportunity.
Introduction

*Austropuccinia psidii* (myrtle rust) threatens Myrtaceae around New Zealand since its arrival here in 2017. Little is known about how the environment influences the life cycle of the myrtle rust pathogen. This experiment was designed to test potential environmental drivers; light availability, nutrition provided to the host plant and temperature, to see which has the greatest impact on disease progression and the development of sexual spore stage (telia). *Metrosideros excelsa* (Pōhutukawa) is a highly susceptible Myrtle in New Zealand so this plant species was used in the experiment.

Preliminary results

- Symptoms first showed seven days post inoculation
- No sexual spores (teliospores) were produced by day 12, although we expect to see this spore stage only after 4 weeks.
- Greatest levels of disease were recorded at 12 days on unfed plants, under full light at 27°C (Figures 3, 4 & 5).
- The disease usually progresses better on plants of greater health, therefore these results may change after a longer period of time once the fertiliser is in full affect.
- Infection of controls could be due to contamination from the inoculated plants, especially in 27°C, as there were a high number of spores produced.

Methods

1. Experiment set up

   - 224 Pōhutukawa transported to two quarantine rooms
   - Split into 16 blocks of 14 plants, eight blocks per room
   - Room conditions set to 22°C in one room and 27°C in the other and 80% humidity in both as ideal for disease progression
   - Three plants per block under each condition: full light and fed fertiliser, shaded and fed fertiliser, full light and fed water, shaded and fed water
   - Two plants in each block were controls

2. Inoculation

   - Spores produced by inoculating *Syzygium jambos* to build up inoculum for experiment
   - Spores mixed with 0.05% Tween 20 to a concentration of $1 \times 10^5$ spores/ml to form suspension
   - Young growth of Pōhutukawa sprayed as highly susceptible using a pressurised spray gun
   - The two controls from each block sprayed with just Tween 20

3. Monitoring disease progression

   - Disease progression monitored seven and twelve days post-inoculation, then weekly after fourteen days for 8 weeks.
   - Disease progression monitored on each leaf of each plants stems
   - Data collected as the total number of tips with leaves that are infected for each plant
   - High humidity maintained to meet the ideal condition for myrtle rust to grow and reproduce
   - All plants watered three times a week

4. Predicted outcomes

   - Lower light and nutrient availability creates greater stress for the pathogen and will promote the production of sexual spores stage.
   - Higher temperature will result in more rapid resource depletion in leaves and this will also promote sexual spore stage.

All photographs were taken by myself or my supervisor.
Tararu Valley had over 10 mines and six battery sites (1). Historic mines can continue to cause metal contamination of waterways many years after their abandonment (2). Metals impact ecosystems and taonga species near the mine with some metals bioaccumulating throughout the food chain (2). Contamination also poses risks to humans from contact and recreation within these waters (2).

The problem

Tararu Valley had over 10 mines and six battery sites (1). Historic mines can continue to cause metal contamination of waterways many years after their abandonment (2). Metals impact ecosystems and taonga species near the mine with some metals bioaccumulating throughout the food chain (2). Contamination also poses risks to humans from contact and recreation within these waters (2).

The research

Tests were conducted to obtain baseline metal concentrations and identify potential contamination point sources throughout the Tararu Valley.

Key findings

Heavy metal concentrations that exceeded NZ freshwater quality guidelines (3):

- Pb: 19.1%
- Ni: 19.1%
- Cd: 2%
- Zn: 0.8%
- Cu: 0.5%
- As: 0.4%

Ohio Creek had the lowest recorded pH.

Conclusions

Waterbodies within the Tararu Valley were impacted by acid mine drainage, with Sylvia mine being a significant contributor of contamination. DGT performed well in a mine impacted situation showing concentrations of heavy metals often had only small portions which were bioavailable. Their presence, however, can still cause long-term ecosystem and human-health threats, therefore more testing and remediation is recommended.
Provoked Police Shootings in New Zealand

**BACKGROUND**
- A “provoked police shooting” describes a phenomenon where an individual intentionally engages in life-threatening behaviour to provoke police to shoot them (Geberth, 1993).
- The term “suicide by cop” is widely used to describe this but we believe “provoked police shooting” is a more accurate term.
- Prevalence has varied between studies. Hutson (1998) suggested provoked police shootings make up 10-13% of officer-involved shootings in the United States, while recent figures from various countries have been around 30% (Best, Quigley, & Bailey, 2004).
- The traits of the typical perpetrator involved have remained consistent since the 1990s (Patton & Fremouw, 2016).

**METHOD**
- Literature search and review: Using Google Scholar and PsychInfo, the literature on this topic was gathered and reviewed.
- Developing criteria: Previously used criteria from the literature was compared. We decided to use Hutson’s et al. (1998) criteria; it is widely used and well regarded.
- Gathering data: The Independent Police Authority (IPCA) website hosts reports of all investigations since 1995. From all 368 cases, 63 NZ police-involved shootings were identified.
- Applying criteria: Criteria was applied to the reports to identify cases of provoked police shootings. These still need to be cross-referenced with other researchers.
- Analysis of cases: We are reviewing cases for demographic information, indications of mental illness, criminal history etc.

**EXPECTED RESULTS**
- Prior to cross referencing, roughly 30% of cases appear to meet the criteria.
- Based on past research (Patton & Fremouw, 2016), we would expect the following characteristics to be common amongst individuals involved in provoked police shootings:
  - Young adult White male
  - A history of mental health issues
  - A history of criminal activity
  - Involved in a domestic dispute prior to the incident

**DISCUSSION**
- Although the results are not finalised, what we have found so far is similar to that of findings overseas.
- Drawing data from IPCA reports meant we had no ethnicity data. The information in these reports was limited, which sometimes made it difficult to identify whether cases met the criteria.
- We hope to access additional data to address these issues.

**REFERENCES & ACKNOWLEDGEMENTS**

Thank you to my supervisors, research team and the Summer Scholarship programme coordinators.
Queue Flies, Come Bother Us!

Blowflies... Why Bother?
The focus of invasion biology is to identify what enables species’ establishment and spread. This research asked, “do life history traits of blowflies correspond to their invasive status?”.

The focus was on Calliphora blowflies, which cause major economic impacts due to pathogen transmission and flystrike. Four species were targeted, including a NZ endemic species: C. quadrimaculata (Fig. 1), two mildly invasive Australian species: C. stygia (Fig. 2) and C. hilli (Fig. 3), and a highly invasive global species: C. vicina (Fig. 4).

A blowfly identification process of specimens that were sent in from all over New Zealand and some from Australia took place to begin finding an answer.

Methods: How to Identify a Blowfly

For more information on how to identify blowflies, scan here!

Results: Future Expectations
The total number of species identified was 229 C. hilli, 239 C. stygia, 163 C. vicina, and 48 C. quadrimaculata.

After identifying each species, we prepared the samples for future genetic analysis via DNA extraction. I also helped catch live specimens and established breeding colonies for each species to enable study of their invasive characteristics.

We want to find out whether certain fitness-based invasive traits (e.g., lifespan, developmental rate, number of eggs laid) are superior in more invasive vs. less invasive endemic species. This will help us to determine the factors that underline invasion and establishment success.

Conclusion: In the End
Invasive species are a major threat to native taonga species and primary industries.

This research can potentially help with future ways to prevent invasive species from entering New Zealand or help to control already settled pest invaders.

For more information on how to identify blowflies, scan here!
A PLACE AND ITS PEOPLE
A LOCATION BASED APP FOR THE UNIVERSITY OF WAIKATO

BACKGROUND
The University of Waikato campus covers 65 hectares. The building began on land that was Ngāti Hauā and Ngāti Wairere tribal boundaries of Tainui in the 1960s. Much of this land was confiscated in 1864. Since then, there have been many people involved in the progression of the university.

PROBLEM
There are many places across the University of Waikato that go unnoticed. These places hold historical stories of our Māori people and land. Recognising these people, places and stories will help to build the understanding of the University of Waikato’s motto, ‘Ko te Tangata, for the people’.

AIM
To design and develop an app for the University of Waikato. A place and its people is a mobile application that is intended to educate visitors, university staff and students about the history and stories that have moulded the University of Waikato into what it is today.

To achieve this goal, the application has guided walks throughout the university with multiple places and stories attached to it. The walks focus on significant places and people in relation to the University of Waikato.

METHODS
- Research
- Interviews
- Moodboard
- Wireframe
- Creating a prototype app to determine functionality and usability.
- Discussion of overall app design.
Mabel Foo
Division of Health, Engineering, Computing and Science

**MODELLING HOW A VIRUS COULD SPREAD THROUGH HAMILTON**

**INTRODUCTION**
To simulate how a pandemic could spread through Hamilton city, a model focusing on COVID-19 was developed.

**THE MODEL**
A commonly used model called the SEIR (Susceptible, Exposed, Infectious and Recovered) model was used to estimate the behavior of COVID-19.

It estimates disease behavior by categorizing a total population into different categories, hence, the SEIR. The number of people in each category is predicted by estimating certain parameters. Such parameters could be transmission rates and vaccine efficacy.

The model can be altered to add in additional state dynamics(Toles and Luong, 2020). Figure 1, on the left shows alterations of the SEIR model which was used in the simulation specific to Hamilton.

**COVID-19 IN HAMILTON?**
3 parameters were chosen for the model. These were as follows: lockdown, mitigation and constant transmission rates. Within these 3 parameters, sub parameters such as incubation and vaccination rates were experimented with.

**LOCKDOWN**
Hamilton has been in lockdown for approximately 120 days over the last 2 years (730 days)(New Zealand Government, 2021).

If Hamilton was only in lockdown for a total of 50 days instead, this is what the number of cases would look like (figure 2).

Scenario 1 indicates that the peak proportion of cases would have been 1.77% of the Hamilton population. That is approximately 3168 cases!

This is why it is crucial that lockdown is not lifted too early.

**MITIGATION**
Mitigation is known as the act of reducing the impact of a virus(CDC, 2021). In the case for Aotearoa, alert levels and traffic light systems were put into place(MOH, 2020 and 2021).

Figures 3 and 4 show constant transmission rates falling from 6 people to 1 person. The η values are the rates at which COVID-19 restrictions are implemented. Constant transmission rate is the speed at which the virus is spread at.

This is one person contacts the virus and spreads it to 2 people. Then those 2 people spread it to another 2 people and so on (figure 12)(Tom Rocks Maths, 2020).

It is evident from the plots that the more strict the COVID-19 restrictions become, the amount of time taken for R0’s to plateau decreases in Hamilton.

**CONSTANT TRANSMISSION RATES(R0)**

Figures 3 and 4 - mitigation plots of R0 with different COVID-19 restrictions, respectively(QuantEcon, n.d)

This is for an incubation period of 5 days and 14 days, respectively.

Incubation period is the number of days it takes for symptoms of the virus to show(Healthline, 2021). As shown in the graphs, the longer the incubation rate, the higher the number of people infected. No one ever shows symptoms immediately after contracting a virus. Hence, why a longer incubation period results in more COVID-19 cases(WHO, n.d).

**VACCINATIONS**

"Where we used to say stay home to save lives, we now need to be vaccinated to save lives." (Prime Minster, 2021 as cited in 1News, 2021).

Figure 10 compares the difference in lifting lockdown earlier than planned and as planned for the vaccinated population. That is, 50 days and 120 days, respectively.

It is evident that for the vaccinated population coming out of lockdown earlier then as planned would result in only a slight increase in cases. Thus, why Adern set a target of 90% of eligible people to be “fully vaccinated in all DHB areas”(1News, 2021). This was to help ease New Zealand out of lockdown.

**REFERENCES**

- QuantEcon. Accesed 27th January 2022.
- References for transmission down...
A UV Light Trap

**Background**
From November 2021 to February 2022, this UV light trap was used in the context of capturing surrounding light sensitive insects within the surrounding tree nurseries of the crown research institute 'Scion'. Here I give a brief rundown on the performance of the light UV light trap through highlighted features.

**Methods**
The trap was set daily with replacement/recharge of the 12 VOLT D.C. 8 WATT battery being the only essential element to the traps functionality (5-6 hours recharge time). Once powered the battery was connected to a sensor letting the trap operate automatically by night. The next day, the samples were collected.

**Results - Taken from 1 days’ worth of catchment:**
- Coleoptera (Beetles) - 222 (12.3%)
- Dermaptera (Earwigs) - 2 (0.1%)
- Diptera (Flies, Mosquitoes, gnats) - 543 (30.1%)
- Hemiptera (True bugs) - 10 (0.6%)
- Lepidoptera (Moths) - 197 (10.9%)
- Neuroptera (lacewings, mantisps) - 12 (0.7%)
- Trichoptera (caddisflies) - 819 (45.4%)

**Conclusion (Pros & Cons)**
- Easily portable.
- Simple setup.
- Daily usage.
- Basic weather resistance.
- Requires external storage supplies.
- Daily battery recharge.

**More information:**
- Designed by Australian Entomological supplies
- Background Project Supervisor:
  - Jason Shiller
- Poster By:
  - Dillion Gates
- University of Waikato Summer Research Program (2021-2022)
The Beginning, Acting, Telling (BAT) model is a research model intended to engage younger people with its youthful and colourful design. It is used when learning to conduct inquiries and teaches children integral skills from an early age. The goal for this summer scholarship was to use practice-based research to develop research tools for children in New Zealand, the United States of America, and Canada. These tools will be used to support teachers, students, and parents who engage with the BAT Model in the classroom and in the home.

Going forward, the BAT and its supporting resources will be tested in schools across New Zealand, the United States of America, and Canada. This will allow research insights into how our design solutions and the BAT Research Model support children’s inquiry based learning.
**LET ME TELL YOU ABOUT SEAWEED!**

**What is seaweed?**

Macroalgae, more commonly known as seaweeds, belong to the three major phyla: Chlorophyta (green algae), Phaeophyta (brown algae), and Rhodophyta (red algae). These come in a wide range of sizes, from small turfing forms only a few cm high to giant kelp, which can grow up to 53 m tall although most species are medium-sized.

The term seaweed is misleading, as most seaweeds are not invasive and harmful as many terrestrial weeds are. Instead, the "weeds" of the sea are an essential element in marine ecosystems, providing a source of food and habitat; seaweeds are also commercially used for a multitude of products ranging from direct human consumption to highly refined extracts (primarily hydrocolloids) used as texturisers in processed foods, for medical products, in textile printing, and other industrial processes.

**Seaweed lifecycles:**

- **Ecklonia radiata/Brown seaweed:**
  - Reproduction can be sexual or asexual (vegetative fragmentation)
  - Different stages may be morphologically different or identical but with different ploidy (n, 2n, 4n, 5n, etc.).
  - In general, reproduction is controlled by environmental factors such as light quality, temperature, and day length.

- **Ulva sp./Green seaweed:**
  - Reproduction can be sexual or asexual
  - Different stages may be morphologically different
  - In general, reproduction is controlled by environmental factors such as light quality, temperature, and day length.

**Why cultivate seaweed?**

Aquaculture accounts for 97% of global seaweed production (1.34 million tons, 2019), with wild harvesting accounting for only just over 1 million tonnes. As demand for a specific species grows, aquaculture increases in importance in order to meet this demand while minimising effects on natural populations and providing a stable and more reliable supply. Additionally, the cultivation of seaweeds provides ecosystem services to may result in environmental, social, and economic benefits.

**Positive effects of aquaculture:**

- More reliable and stable large-scale supply
- Provision of ecosystem services, e.g. habitat provision, increased biodiversity, bioremediation, gas and climate regulation, etc.
- Coastal protection.

While there are examples of responsible and sustainable harvesting of natural populations of wild seaweed, a range of risks remains.

**Potential negative effects of wild harvesting:**

- Loss of habitat and shelter for species, alongside the loss of direct and indirect food sources.
- Loss of nursery grounds for juvenile invertebrates and fish, resulting in consequences for species at higher trophic levels and commercial fish stocks.
- Loss of the physical modification effects to coasts, such as wave damping, which may lead to increases in coastal erosion or flooding events, and
- Loss of carbon stores and sinks that are provided by seaweeds.

I would like to express my gratitude to my supervisors, Marie Magnusson and Rebecca Lawton in giving me this opportunity and the funding from the University of Waikato and Priority One.

By Maro Guy
Amino Acids in Speleothems as a Proxy for Paleo Ecosystem-Climate Feedbacks

Background & Introduction

- Speleothems contain Trapped Organic Matter (TOM). Through uranium-thorium dating the age of TOM can be identified.¹
- Aromatic Amino Acids (AAAs) fluoresce. As synthesis cost is high (40.3 – 76.3 Pi) fluorescence intensity relates to energy economy.²
- Biosynthesised AA’s tend to have reduced 13C abundance due to Kinetic Isotope Effects (KIE) where 12C is favoured in reactions.³
- This is due to 13C having lower zero point energy than 12C, meaning the energy to reach activation is greater for 13C than 12C.⁴

Results & Discussion

- The fluorescence Excitation Emission Matrices (EEM) from speleothem sub-samples (Figure 1) yielded a moderate signal at λex/em: ~200-230/~275-330 nm.
- This approximates standard amino acid-like fluorescence λex/em: ~225-300/~275-350 nm (Phe, Tyr, and Trp).⁵

Further Research & Conclusion

- We have found evidence that position specific KIE occurs in histidine biosynthesis. We can now confidently analyse 13C in speleothem AAA’s.
- Liquid chromatography will be used to purify these AAAs from sub-samples for quantitative 13C NMR.
- The amount of KIE occurring in pure AAAs indicates frequency of biosynthesis, providing insight into economy in the paleo library.
- This proxy can align data with dates and locations, providing a clearer picture of past climate and potentially informing climate change predictions.

Bibliography & Acknowledgments

2. Smith D. R., Chapman M. R. (2010). Economical Evolution: Microbes Reduce the Synthetic Cost of Extracellular Proteins. Supplementary material S1; Table S1. University of Michigan, Ann Arbor, Michigan, USA.

Thanks to Dr. Hayden Thomas for your technical expertise in NMR.
Thanks to Sebastian Hoepker for lab assistance.
Thanks to Dori Torres-Rojas for supplying desperately needed D2O.
Thanks to Philip Hagan and Rachael Ace for much needed artistic advice.
The Bay of Plenty is a rapidly growing area, with a population increase of 2.8% for the year ended June 2020. With this increase, higher traffic flows and congestion are expected. This comes at both an environmental and economic cost. With so many various traffic scenarios, Priority One created a suitable traffic model for the Bay of Plenty that was able to simulate a small dataset of real-life commutes on a virtual road network.

The overall goal of this project was to use the existing Simulation of Urban MObility (SUMO) model to create a prototype of the Bay of Plenty roading network. My aim was to create a digital traffic twin that can illustrate possible features for highlighting useful commuter information to key stakeholders to make more informed transport planning decisions in their communities.

In order to illustrate these features, mock traffic scenarios were created to show how a large-scale simulation would operate. These simulations were integrated into the prototype and additional functionality was implemented on top to demonstrate how detailed data could be used effectively to analyse and understand commuter behaviour on the roads.

Following the creation of the Bay of Plenty digital traffic twin prototype, key stakeholders should seriously consider further developing a traffic simulation tool. The prototype has demonstrated that with the right data available, useful commuter information can be analysed for further transport planning. Having an effective visualisation tool to virtualise a road network allows for informed decisions to be made, reducing the overall cost on our environment.

Investigating Commuter Data in the Bay of Plenty
Zane Hamilton, Dr. Jessica Turner, Shane Stuart

I would like to personally thank my supervisors Dr. Jessica Turner and Shane Stuart for the opportunity to be a part of this project and their positive guidance throughout. I would also like to give special thanks to both Priority One and the University of Waikato Summer Research Scholarship Program for making this project possible.
**NZ ARCHAEOLOGICAL RADIOCARBON DATE DATABASE**

**LUCY HUGHES, SIMON BICKLER, AND FIONA PETCHY**

IT IS MAITAI LABORATORY OF SCIENCE, UNIVERSITY OF WAIKATO, NEW ZEALAND

A New Database

Our goal is to draw these resources together and develop a GIS-centric system database template using ArcGIS. The new database will enable the investigation of cultural, economic, and environmental questions relating to the initial Māori settlement of Aotearoa and will contribute to:

- **Archaeological heritage management.**
- **Iwi cultural mapping.**
- **And more!**

### Results

- **3000+ dates collated and linked to context and publications.**
- **Development of a prototype geospatial 14C database.**

### Future Considerations

- Requisition of permissions for unpublished radiocarbon dates from previous submitters.
- Continuing search of grey literature for missed radiocarbon dates.
- Assignation of NZAA Site IDs to radiocarbon dates without any submitted geospatial information.

### References


### Potential for Geospatial Analyses

- Increased accessibility to radiocarbon dates for archaeological analysis.
- Insight into atmospheric and oceanographic impacts on Māori settlers.
- Standardisation of quality management.
- Enables greater temporal resolution of short NZ chronology.
Impacts of Remote Peering on Traffic Delivery
Connor Jones, Fabricio Mazzola, Marinho Barcellos, Pedro Marcos

1 Motivation and problem
Remote peering (RP) enables Autonomous Systems (AS) connectivity to IXPs without having a physical presence at their switching infrastructure. RP usage is still poorly understood. Its invisibility leads to unpredictable behavior of applications and interconnection quality. Recent studies [1,2,3] have focused mainly on inferring RP at IXPs or briefly analyzing RP implications to the Internet (anycast, outages).

It remains unclear how RP reflects on IXP routing data (IPv4 and IPv6), whether using different connection types (RP, local peering, transit provider) to reach remote prefixes at IXPs can have substantially different latencies and if announcing the same prefixes to local and remote IXPs can introduce unintended performance problems to ASes connected at multiple IXPs.

2 Research questions
1. What is the number of remote interfaces, prefixes, and routes at different IXPs? How does the usage of IPv4 compare with IPv6 for RP?
2. Does RP introduce latency impacts to reach remote prefixes at IXPs? Are the results comparable between IPv4 and IPv6?
3. Can prefixes announced via RP introduce unintended performance problems to ASes connected at multiple IXPs?

5 Ongoing work
Our preliminary analysis investigates the IPv4 and IPv6 RP’s prevalence in eight of the largest IXPs by membership worldwide and presents a latency impacts analysis to AMS-IX. We are also working to understand better whether prefixes IPv4 and IPv6 RP routes have similar proportions to the remote prefixes.

6 References

4 Preliminary findings
A. RP at IXP routing data (IPv4 vs IPv6)
Out of all interfaces, the fractions of remote are similar when comparing IPv4 and IPv6. IPv4 and IPv6 RP routes have similar proportions to the remote prefixes.

B. Latency comparison to reach remote prefixes via remote, local peering or Transit routes (IPv4 vs IPv6)

<table>
<thead>
<tr>
<th></th>
<th>IPv4</th>
<th>IPv6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prefixes with local and remote routes</td>
<td>Remote lower RTT</td>
<td>Local lower RTT</td>
</tr>
<tr>
<td>AMS-IX IPv4</td>
<td>6644 (38.8%)</td>
<td>10477 (61.1%)</td>
</tr>
<tr>
<td>AMS-IX IPv6</td>
<td>1208 (35.5%)</td>
<td>2191 (66.4%)</td>
</tr>
</tbody>
</table>

- Different from interfaces, the fraction of IPv4 and IPv6 prefixes widely varies across IXPs.
- While some IXPs show a prevalence of IPv6 remote prefixes, others still extensively rely on IPv4.
Background & Aim: Nitrogen is an essential, but complex nutrient for plant growth. In soil, nitrogen undergoes a range of processes and transformations, and is not always accessible to plants. Maize is grown on dairy farms around New Zealand for silage, the primary form of feed supplement for cattle. This research project aimed to understand more of the complex nitrogen transformations in soil underneath a maize crop.

Methodology: Soil cores were taken from two adjacent maize paddocks in the Waikato biweekly from late November until mid December, and weekly onwards until mid January. Potassium sulfate extractions were carried out after each sampling occasion and further analysed for ammonium and nitrate on a Skalar SAN++ segmented flow analyser.

Results: There was a consistent decrease in extractable inorganic nitrogen due to plant uptake and maize growth. There was very little fluctuation in extractable organic nitrogen due to most EON being resistant to decomposition and variations in extraction methodology. However, the EON pool represents potentially mineralisable, available nitrogen and the EIN pool has undergone nitrification.

Conclusions: This research is a part of a wider trial to understand soil nitrogen processes under cultivation where the paddock was previously in pasture. This project has found that under maize, there is a consistent reduction in extractable organic nitrogen due to maize up-take, and further analysis will link these processes to N₂O emissions and climatic factors.
Jana Longney  
Division of Health, Engineering, Computing and Science

**Background**
NZ emits ~55 million tonnes of carbon dioxide (equivalent) per year. Yet, there are currently no large scale carbon capture efforts and technology available. (3)

Silicate weathering is a natural process that drives the cycling capture and sequestration of CO2 (as carbonate minerals) at the ocean floor on geologic time scales [1-4].

Recent modeling efforts highlight that enhanced rock weathering (ERW) on agricultural land can sequester carbon on the gigatonne scale [1,2].

Based on preliminary data, we estimate that ERW can sequester up to 80% of NZ’s net emission via ERW. [3,4]

Alongside ERW brings huge potential to enhance and boost crop growth through the increased availability of macro & micro-nutrients.

**Aim**
- Varied application of Dunite (an abundant silicate rock in NZ) to agricultural land (0-40 tonne per ha)
- Quantify carbon capture rates possible with Dunite
- Quantify the effect of ERW on crop growth rates and yield, and soil chemistry (pH, total carbon, trace metals)

**Results**
- ERW increased the germination rate of maize in all our plots relative to the controls (Fig. 1)
- Silking peaked at 30 tonnes per ha (Fig.2)
- Carbon capture rates are currently being processed
- Yield by weight are to be determined at the end of the growing season

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**References**

- Jana Longney & Terry Isson

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**Application rates (tonnes/ha)**

<table>
<thead>
<tr>
<th>Application rates (tonnes/ha)</th>
<th>Average % of successful Germinations</th>
<th>Average % of successful silking</th>
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</thead>
<tbody>
<tr>
<td>0</td>
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<td>10</td>
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<td>30</td>
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**Acknowledgments**
To Agri-nutrients Balance, Ngapeke Permaculture & Waikato University’s Summer Research Programme.
**Objective**

- To identify the distribution of arc and intraplate rocks on Karioi using petrography and XRF analysis.

**Karioi Maunga**

- Karioi is one of the only volcanoes on Earth where **arc** and **intraplate** basalt were erupted from the same vent system.
- Arc basalt is linked to **subduction** zones, while intraplate basalts usually erupt **far away** from them.
- This phenomena may be caused by tearing of the ancient Pacific Plate below North Island.

**Alexandra Volcanic Group**

- Arc basalt
- Intraplate basalt

**Method and Progress**

- Collect rocks → make thin sections and fused disks. 63 new thin sections made, initial petrographic analysis done.

**Future steps**

- XRF analysis of 100 new and old samples to measure **major** and **trace** element composition of Karioi’s lavas.
- Geochemical grouping of arc and intraplate basalts using high field strength elements, e.g. TiO2 and Nb.

**Under the microscope**

- Clinopyroxene rich, especially in the ankaramites (megacrysts).
- Abundant plagioclase.
- Relatively poor in olivine.

**Key reference**

Background
Resilience-based earthquake engineering (RBEE) can be used to approximate earthquake damage and required repairs in buildings, how damage may affect the operation of the building’s intended purpose, and the functionality level over the recovery time [1]. Hospitals are essential facilities that must remain operational after earthquakes. However, they have been rendered partly or completely non-functional in past events [2,3], as hospitals with no structural damage may still experience significant non-structural damage [1]. RBEE can highlight weaknesses that may disrupt hospital services and be used to improve design.

The project
This research investigated links between physical damage and drops in hospital functionality. This was completed by reviewing published documents and creating a database of post-disaster healthcare facility operation levels. Dependencies between hospital space, staff, and stuff were mapped using combined event trees and fault trees, which are common risk analysis tools. These trees can provide instant feedback on the functionality level.

Sample of results – Emergency Department case study

Fault Tree:
A top-level failure (in yellow) is broken down into all events that would cause the failure. AND and OR logic gates are used to determine what events lead to failure.

Event Tree:
An initial event (in grey) leads to all subsequent events (in yellow) that may occur before reaching a final state (in purple).

Application
The process developed will be applied to other hospital departments. This will provide a thorough overview of the critical relationships between the hospital’s space, staff and stuff. It will then be used to create a functionality dashboard. The purpose of this dashboard is to provide real-time information to hospital staff about the functionality level of all hospital departments after an earthquake, including the state of critical services, wait time and estimated time to full recovery.

Acknowledgements
We thank the Catalyst: Seeding funding provided for this research by the New Zealand Ministry of Business, Innovation and Employment and administered by the Royal Society Te Apārangi. We also thank the University of Waikato Summer Research Scholarship Programme for this opportunity.
QUALITY OF LIFE AND THE IMPACT OF SMART ENVIRONMENTS

BACKGROUND

SMART LIVING ENVIRONMENTS
At risk groups like the elderly can find it difficult to live at home alone. Smart living environments use technology in the occupants’ homes to measure quality of life and provide assistance in daily activities.

QUALITY OF LIFE (QoL)
QoL is subjective. According to the WHO, QoL is “an individual’s perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns.”

RESEARCH AIMS
1. How is QoL quantified?
2. What are the negative impacts of smart environments?
3. How can methods such as AI be used to understand and mitigate the impacts of these technologies?

RESULTS

QUANTIFYING QUALITY OF LIFE
The WHOQOL-BREF, WHOQOL-100, SP-36 and EQ-5D are the main surveys used to quantify and measure QoL. The SP-36 is based on health-related QoL, while the WHOQOL-100 is based on social-related QoL.

NEGATIVE IMPACTS OF SMART ENVIRONMENTS
1. Poor data security
2. Social inequality of distributed smart environments
3. Underrepresented social groups during technological development
4. Bugs in software
5. Neurotic effects on the user (i.e. obsession, anxiety)
6. Social stigmatization from using these smart environments
7. The risk of misuse
8. Digital illiteracy and mistrust in elderly populations

CONCLUSION

Emotions such as anxiety, stress and depression are directly related to a person’s quality of life. Using AI, these emotions can be automatically detected in smart environments using different techniques. These include analyzing a person’s text linguistics, speech, facial expression, behavioral responses, physiological signals, mobile phone usage, and computer usage. These technologies will eventually replace the burden of completing QoL surveys.

In conclusion, the use of QoL surveys, AI technologies and being aware of the negative impacts of smart environments can be used to develop technology for smart home environments.

REFERENCES
1. Huang & Wu, “Do the SF-36 and WHOQOL-BREF Measure the Same Constructs?”
5. Alberdi & Azpira, “Towards an automatic early stress recognition system for office environments”
CO-DESIGNING A MOBILE GAME FOR COMPUTATIONAL THINKING SKILLS

BACKGROUND
The Zealand digital technologies curriculum emphasizes the need for students to be taught digital-related skills within an “authentic technological context.” While there are many resources related to digital learning, few embed this within such a context.

AIM
This project involves designing and developing an app that can teach the computational thinking skills of sequencing and orientation in an authentic and meaningful way. To achieve this, the app facilitates the co-design of a “tour” game with a student’s own map and locations.

METHODS
To create the application, the open-source software development kit Solar2D and Lua programming language were used. A prototype of the game was built and tested with the researchers in our team.

Tiana Mayo
Supervisors: Shaoqun Wu & Wendy Fox-Turnbull

FEATURES
1. Students set locations on their own picture or drawing to create a map.
2. Images and audio can be added to each location to be displayed during the tour.
3. Students select locations in a specific sequence that are to be visited.
4. To complete the tour, students navigate between the locations only using the specified buttons.
Towards a Greater Appreciation of Middle Ear Epithelium

Finlay McGrath, Linda Peters and Tony Cecire
Te Aka Mātua, School of Science

Introduction
Otitis Media is a bacterial/viral infection of the middle ear (ME). In NZ 1 in 4 children will experience an acute ME infection before the age of 5. In this research project we set out to model the cell structure and function of the ME to generate a platform for further study into the possible cause and effects of ME infection.

Preparing the Specimen
- Wild type adult male mouse heads (Strain - CS7).
- The tissue was embedded in a paraffin wax block and sliced into thin pieces using a microtome.
- The cross sections of tissue were transferred onto gelatin covered microscope slides.

H&E Staining (Haematoxylin & Eosin)
- Haematoxylin solution stains nuclear chromatin a dark blue/purple.
- Eosin solution has a “three-tone effect” demonstrating three different pink shades between red blood cells (most intense), collagen and smooth muscle.

Ah Yes Surfactant, What’s That...
- Surfactant Protein A (SP-A) is most abundantly found in Lung tissue and is produced by surfactant protein in bone marrow.
- SP-A plays a key role in providing defence against respiratory pathogens. In the ME SP-A is likely produced in the temporal bone.

Canaliculi, Cana-what Now?!
- Canaliculi are small channels within the body.
- In the ME we’ve observed canaliculi that connect the mouse temporal bone with ME epithelium.
- The presence of these channels strongly suggest a pathway for which SP-A can be produced and distributed within the ME.

Middle Ear under the Microscope

Application For Middle Ear Infection
- SP-A in the mouse ME begs the questions,
  - Does the middle ear act as a sort of pseudo alveolus?
  - could ME SP-A serve a similar function as in the lungs?
  - If so does that infer that ME infection can be modelled as a lung infection and subsequently treated like one?
Hopefully this project will initiate further research into the role of SP-A in the ME for the near future.
BACKGROUND

N₂O is a greenhouse gas with a global warming potential 273 times that of CO₂ (IPCC, 2021). Agriculture makes up nearly 50% of New Zealand’s gross emissions (Ministry for the Environment, 2021) with N₂O accounting for 10% of the total emissions in New Zealand (Ministry for the Environment, 2013). Nitrogen accumulations (in the form of urea and dung) on the grazed turnip paddock (Figure 1) being studied is expected to cause increased N₂O emissions as the nitrogen accumulates in the soil over time (Wecking, 2021). Consequently, there is a need to quantify N₂O emissions from turnip cropping system to aid in mitigating the negative effects of global warming and climate change.

EXPERIMENTAL DESIGN

Part 1

A total of 12 chambers across both ungrazed turnips and pasture were sampled to identify what areas of the method could be refined and gather preliminary data. These chambers were sampled four times over a two week period.

Part 2

Using the optimised method derived in part 1, the turnip paddock was sampled with 12 chambers following grazing. Intensive sampling was conducted every day for five days after grazing.

METHODS

- The chambers of approximately 200mm diameters were placed on collars pre-installed at the site (Figure 2). These are then sealed which allows gases to accumulate in the airspace over time.
- The accumulated gases are sampled over a 60 minute period, with 10mL samples being taken every 20 minutes and then stored in an air tight evacuated vial.
- These gas samples were then analysed using a quantum cascade laser absorption spectrometer (OCS) in field which allowed the flux of N₂O to be calculated.
- The same samples were also analysed for CO₂ to act as a form of quality control for the N₂O data.

REFERENCES

- IPCC. (2021).

RESULTS

A positive flux of N₂O was identified from the grazed turnip crop, indicating that there was an emission of N₂O from this ecosystem across the sampling days. The flux peaked on the third day of sampling at 216 ug N₂O m⁻² h⁻¹. On average, the daily flux of N₂O was 122 ug N₂O m⁻² h⁻¹ which aligns with literature values for the flux of N₂O on pasture ranging from 71–183 ug N₂O m⁻² h⁻¹ (Buchen et al., 2017; Helfrich et al., 2020).

We can be more confident in these findings as a multitude of improvements were undertaken after part 1 of the experimental design to optimize the methods being used. Some of these improvements included:
- Ensuring that the chamber collars were tight to avoid any leaking or gases escaping.
- Making sure the vials were over-pressurised and not leaking to preserve the integrity of the samples collected.

CONCLUSIONS AND FUTURE WORK

So far in this research project, it can be concluded that there is an emission of N₂O from the grazed turnip paddock over time after the turnips have been eaten by the cows. However, these results need more data to be conclusive, so biweekly sampling will continue to occur for the two weeks after the intensive sampling week in order to gain an insight into the bigger picture surrounding N₂O emissions on grazed turnip systems.
EXPLORING NEW TREATMENTS FOR NEISSERIA GONORHOEAE
Jessie Mellsop-Kupe & supervisor Dr. William Kelton

OUR AIM:
Our aim for this project was to express antibodies within cells and prevent them from being exported. This is an initial step in the potential development of new frontline treatments for Neisseria gonorrhoeae bacteria that hide within living cells.

- Gonorrhoea is becoming increasingly resistant to traditional treatment [1]
- Currently there is an average of 117 cases per 100,000, although research from ESR suggests that global events such as Covid-19 could inhibit true data collection[1].

METHOD:
To express antibodies inside cells we designed a series of plasmids with and without signal peptides that are responsible for directing antibodies outside of cells.

1. Mammalian cell culture
   We cultured Human Embryonic Kidney cells for a week, in preparation for transfection

2. E. Coli bacteria culture and Transformation
   Pre purchased plasmids were introduced to E. coli bacteria and our samples were left to culture on agar. Once we had big enough colonies on our agar, we took a small sample and added it to a growth media for overnight culture. Plasmids were extracted and stored for transfection

3. Transfect Mammalian cells with plasmids
   Our cells were cultured, and prepared for transfection 24 hours before the experiment. The cells and plasmids were combined with transfection reagents, enhancers and media and left to incubate for 4-6 days

4. Analyse samples
   We took small samples from day 4 and 6 of our intra- and extra-cellular expression samples. We used the western blot technique to visualise antibody expression in our samples

OUR FINDINGS:
We have evidence of successful antibody expression within cells (Blue arrows). However, the double band suggests there is a larger protein present as well.

Each dark line on Figure 1 above visualises antibodies present in the samples of cells we tested. A second sample analysis was completed which gave similar results as the ones provided above. Our next step is to replicate the process again to confirm our results.

Figure 1. Example Western blot showing antibody expression in our cell samples.
Encouraging commuters to shift their way of travel will have greater impact in reducing congestion. Currently, there is no suitable technological tool to understand the way people commute. To change the way people commute we must first understand their behaviour.

New Zealand’s population has reached 5 million in 2020. As the population of our major cities continue to increase, so has the volume of vehicles traveling on roads. Roads become congested as commuters travel at the same time.

The application was designed with three key ideas: scalability, code reusability and updatability. To achieve this, the app follows the Model-View-Controller architecture.

Overall, the app provides a robust way to track commutes and aggregate data. It can be used by individuals wanting to track the way they commute. It can also be used by organisations supporting congestion and carbon reduction initiatives or regional and transport planners as the data collected can be analysed to understand commuter behaviour.

After installing the app
1. Accept the permissions
2. Add your addresses
3. Set your schedule
4. Let the app do the rest!

Uploads to the server can be done passively or at the discretion of the user.

References

Poster by Rhane Mercado
Supervised by Dr Jessica Turner and special thanks to Shane Stuart (Innovation Manager at Priority One)
Acknowledgements to University of Waikato Summer Research Program and Priority One

Division of Health, Engineering, Computing and Science
The University of Waikato

Bhaven Mistry

Division of Health, Engineering, Computing and Science

INTRODUCTION
Solar PV Systems are a renewable energy source that converts light radiation into electricity (Figure 1).

Maraes have monthly power bills between $200-$500; the majority do not have solar panels [2]. Solar Panels on Marae could significantly reduce monthly power bills.

This project aims to evaluate the economic feasibility of Solar PV Energy systems in Marae.

METHOD
The suitable North facing roof area were measured and annual energy usage and costs were estimated for over 100 Marae within the Waikato region. The number of solar panels per Marae was also calculated.

Solar PV System size, panel sizing, annual output, and cost were calculated. And Solar PV battery costs, storage capacity and size were calculated.

Economic and financial analyses were conducted using capital budgeting techniques and various solar PV system combinations to determine the best solution for Maraes.

FINDINGS
Figure 2 shows various results from financial analysis.

2Kw-4Kw solar PV systems cannot meet energy demands.

Financial analysis shows various suitable solar PV system combinations for Maraes, however, the best combination depends on the individual Marae characteristics.

A 10Kw system meeting a proportion of annual energy demand is more suited for a marae with an annual energy demand of 9400 Kwh-15000 Kwh. Whereas, a smaller 6Kw system matching annual demand is more suited for Maraes with annual energy usage less than 8000 Kwh.

CONCLUSION
Preliminary financial analysis shows solar PV systems are economically feasible and can provide Marae with significant savings to monthly power bills.

Some systems and energy demand show positive NPV (Net present value) and an LCOE (Levelized cost of energy) lower than the cost of grid electricity which is promising.

There is not a universal solution that suits all Marae. Further research is required with detailed analysis. A extensive consultation is required with each Marae to determine the best Solar PV System solution based on their circumstances.

References:
The purpose of this project is to integrate facial recognition and image classification technologies to train a deep learning network to recognize individual oysters based on their shell patterns and colors.

In both aquaculture and agriculture studies, AI has been demonstrated to be capable of recognising individual animals or plants. The likelihood that AI will be able to recognise individual shellfish will allow shellfish to be properly classified and placed in their appropriate families. This method can increase the number of families that can be preserved in selective breeding operations, allowing breeding programmes to evolve more quickly.

The oysters are the center of this project. The necessity to divide oyster families in breeding programs is avoided by issuing each oyster a unique ID that may be remembered subsequently. From a practical standpoint, this is useful since it allows oysters in the breeding program to be stored together, decreasing the physical space and time needed to maintain them. However, as it is manually done generating breeding data can be time-consuming, labor-intensive, and can slow down breeding programs.

Two datasets were used in this research: a Mussel dataset and a Synthetic dataset that was generated to mimic oyster patterns and colors.

- **Purpose**
  - The purpose of this project is to integrate facial recognition and image classification technologies to train a deep learning network to recognize individual oysters based on their shell patterns and colors.
- **Background**
  - In both aquaculture and agriculture studies, AI has been demonstrated to be capable of recognising individual animals or plants. The likelihood that AI will be able to recognise individual shellfish will allow shellfish to be properly classified and placed in their appropriate families. This method can increase the number of families that can be preserved in selective breeding operations, allowing breeding programmes to evolve more quickly.
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  - Two datasets were used in this research: a Mussel dataset and a Synthetic dataset that was generated to mimic oyster patterns and colors.
- **Description**
  - **Image Classification - Standard CNN**
    - A pre-trained model named InceptionResNetV2 was used, along with a dense layer with softmax activation. The model was built using an Adam optimizer with a learning rate of 0.001 and a loss function of categorical cross-entropy. The model was set to run for 1000 epochs using an early callback function. With a patience value of 10, the early halting monitors the validation accuracy.
  - **Xception Network**
    - The Siamese network is created by duplicating the augmented base network and creating a new network with two branches. Images are passed to each branch and the distance between the outputs are then calculated. We use an imagenet trained xception backbone without the classification head. We then augment it with a global average pooling layer, flatten it and add a dense layer of the required output dimension.

Both approaches were able to accurately predict mussel & synthetic classes in most cases, but the CNN produced better results. Using a Siamese network to construct an embedding allows us to identify previously unknown mussels & synthetic images, whereas using a CNN needs the network to be trained on every potential mussel or synthetic images before deployment, which is neither feasible or possible.

**Conclusion**

- **Image Classification - Standard CNN**
  - A pre-trained model named InceptionResNetV2 was used, along with a dense layer with softmax activation. The model was built using an Adam optimizer with a learning rate of 0.001 and a loss function of categorical cross-entropy. The model was set to run for 1000 epochs using an early callback function. With a patience value of 10, the early halting monitors the validation accuracy.

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A function was created that calculates the maximum expected accuracy under the assumption that the dataset used to produce the results is representative and that classification is done using the Euclidean distance between some class centre vector and the vector of interest. If the distance between two vectors is less than the threshold then it's a positive and greater or equal it's a negative. This function finds the threshold value that results in the maximum classification accuracy across the dataset given.
Semi-digital twins for self-management of computer systems

Introduction
- Automated analysis of the simulation to adapt the real twin
- Cloud/Edge Simulators assume certain characteristics to simulate large theoretical scenarios
  - Edge devices are limited in computational power but have lower latencies
  - Cloud computing provides large computational power but has a higher latency due to distance from edge
- Using multiple devices, could we emulate the system for a more accurate representation?

Method
- Run image detection on selected devices through funcx
- Conduct detection of weeds using DeepWeeds Dataset
- Compare running on edge device against offloading

Results
Send images to local compute VS Running on edge device

<table>
<thead>
<tr>
<th></th>
<th>20 Images</th>
<th>50 Images</th>
<th>100 Images</th>
<th>200 Images</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jetson Nano</td>
<td>200.6s</td>
<td>242.1s</td>
<td>236.4s</td>
<td>253.4s</td>
</tr>
<tr>
<td>Laptop 960M</td>
<td>14.8s</td>
<td>20.6</td>
<td>25.3s</td>
<td>46.5s</td>
</tr>
</tbody>
</table>

Conclusion
- Utilising funcx, image detection could be run on either device
- Unexpected result due to long startup time of Image Detection on the edge device
- Change in implementation of image detection could reduce times on edge devices drastically

Future Work
- Implementation of more devices on the continuum
- Evaluation against traditional simulations
- Simulating resources and characteristics that would affect performance, e.g.
  - Latency
  - Dropped connections
  - Power consumption
  - Battery Life
  - Cost

Acknowledgements: Omer F Rana, Michael Mayo, Kyle Chard, Ryan Chard, Matt Baughman
INTRODUCTION
Type 2 diabetes is a rapidly growing disease, suffered by over 250,000 New Zealanders [1], and occurs due to insulin resistance in response to unhealthy diet, genetics and obesity. Untreated, this causes excessive glucose levels to remain in the blood and cause other health issues such as renal damage, renal failure and beta cell atrophy [2]. With appropriate management and observation however, these issues can be minimised. As it is most commonly junior doctors managing these patients, it is these individuals that require surveying. With the results provided by this study, we will be able to assess Junior Doctors confidence working with patients with Type 2 diabetes to determine if New Zealand’s medical undergraduate training is proficient enough to keep up with the growing number of diabetic individuals.

METHOD
We created a 6 minute survey consisting of 12 questions which we sent to all New Zealand DHB RMO teams. These will be distributed to the new and already present Junior Doctors. These questions involved a 7 point confidence scale, a tick list of Type 2 diabetes knowledge, and a couple of yes/no response requirements.

We used confidence based questions, rather than knowledge based, as it has previously been shown that Clinicians attitudes towards diabetes and its management may in fact be more important than their academic knowledge of the disease [3].

RESULTS
While we have still not received our results, a similar study has been conducted in the UK [4]. This 4 point confidence-based survey was completed by 2149 UK doctors, and consisted of mainly 2nd year post-graduate students. This survey asked the confidence of the doctors in each of the subjects shown in (Figure 2). Only 27% of participants stated they were “fully confident” in diagnosing diabetes, only 13% diagnosing impaired glucose tolerance, 55% diagnosing and managing hypoglycaemia, 43% diagnosing and managing diabetic ketoacidosis, 20% diagnosing and managing hyperosmolar hyperglycaemic non-ketotic coma, 27% commencing, titrating and discontinuing IV insulin, 39% prescribing IV fluids for diabetic patients, and 18% adapting diabetes therapy prior to procedures such as surgery. 75% of these total participants stated they desire further training in the diagnosis of diabetes, and 70% stated they require more training in the management of diabetic emergencies. Only 19% thought that their undergraduate training adequately prepared them to optimise treatment of diabetes [4].

CONCLUSION
As New Zealand’s healthcare system has been ranked as the same overall quality as the UK’s NHS by ID Medical [5], it would be interesting to see how New Zealand’s junior doctor attitudes compare. What we can conclude from the UK study [4] however, is that these results suggest further education is required for junior doctors in all elements of diabetes diagnosis and management, to increase not only their knowledge, but also their confidence.

Only 27% of 2149 Doctors in the UK are “fully confident” in diagnosing Diabetes (cite)


Dannica Parsons, Dr. Ryan Paul, Lynne Chepulis
Tini o te Hakituri: a technology-based approach to safety for hazardous industries

Author: Jascha Penaredondo
Supervisors: Jemma König and Judy Bowen

Objective
Conduct a user study during different scenarios (i.e. while doing fatigue tests) to collect physiological data such as heart rate, heart rate variability, galvanic skin response and acceleration using the 'Smart Shirt' and Polar HR band. Finally, develop a multi-threaded software application to process complex data.

Key Findings
- Difficult to duplicate real-world work scenarios
- Heart rate is the most non-invasive physiological data to collect that can be used in a meaningful and ethical manner.

Conclusion
Software and hardware malfunctions of any technology are inevitable, especially in this case due to the rugged and isolated environment of the forestry industry. This is something that can be further looked into in future studies.

References

Methodology
- Collect heart rate data from Polar sensor
- Collect electrodermal activity and acceleration data from SmartShirt via hotspot on MobaXterm
- Real-time data stream processing using multi-threading in Python

Results
A set of physiological data is available for further study and analysis of fatigue. A software application that can handle complex processing of such data. Objective and subjective methods used for fatigue tests such as Stanford Sleepiness Scale (SSS), NASA TLX, Psychomotor Vigilance Task (PVT) etc.

Introduction
The Hakituri project developed the 'Smart Shirt' which is an unobtrusive, wearable technology which aims to ethically collect data from forestry workers to find evident patterns and predict hazardous situations caused by workers’ fatigue.

FATALITY RATE 2021
64.23 per 100,000 workers

Background Image from https://www.canterbury.ac.nz/research/specialties/forestry-research/

Tini o te Hakituri: a research project inspired by the era of wearable technology start-ups in 2014 and led by Dr Judy Bowen to improve safety in hazardous industries such as the New Zealand Forestry. The Forestry industry is known to have the highest rate of workplace fatalities in New Zealand [1] with worker fatigue identified as the main cause. Forestry is labour-intensive where most of the tasks involved are physically and mentally demanding. [2]
What does “Home” really mean? The geographical boundaries that I associate with “Home” are shaped by people and memories, and my geographical definition of “Home” will be completely different to yours. Or what about “Town”? When you ask a university student where “Town” is they will most likely provide the general area of their favorite bar, while someone of retirement age would rattle off their favorite coffee shops. All of which is different from the official area of “Town” determined by the Hamilton City Council. This difference of definition is all very intriguing, but how can this data be captured?

This web app needs to perform three fundamental tasks: adding a place (name, description, geometry), storing the place, and viewing the place. The following technologies were used to accomplish these tasks: PHP for the backend, Vue for the frontend, GraphQL to communicate between the front end and the backend, Vue Leaflet for displaying all map data, Overpass Api for retrieving real world data, and SQL for storing the places. The project follows an iterative model of development. The first step is setting up a Vue project. The next step is incorporating Leaflet with pins and areas. Following that, storing and retrieving just the pins. From there, adding in real life data from Overpass and saving/retrieving the border data. The final step is adding in custom border functionality.

The results so far are still in the prototype stage. What has been achieved is a program which can load in any available place data for a point on the map, add a custom name, description, and border for that data, and retrieve all that data on a separate page. All the necessary functionality for adding custom information about a place is in place. There is still a lot of work to be done before this can become operational. Note: some of the ideas and strategies implemented have been influenced by Christopher Jones’ work.

This kind of application has varying applications. Social Geographers can use it to gather data on why people call things what they do. Ordinary people can use it to share their unique names and stories about places. Perhaps if a pronunciation feature were added, tourists could use it as a way of determining how a difficult place name is commonly pronounced or referred to. But before all that the project would need to undertake ethical approval as well as contain a full user login system so that people can manage their own data.
Native freshwater mussels in the juvenile life stage naturally have very low survival rates so when culturing juveniles specifically for conservation and restoration efforts, scientists can experience difficulties in producing enough healthy juveniles.

Within Aotearoa there has been growing interest in researching freshwater mussels not only for their ecological value but also due to the historical importance that they have to Māori, collectively the species found in Aotearoa were known to Māori as Kaakahi or Kaaeo and were used as an important food source by pre and early European Māori. The following research analyses existing and current rearing methods for juvenile mussels that could contribute to successful culturing of the taonga species found within Aotearoa.

A common outcome found was that current methodology seldom produced consistent successful results when rearing species considered threatened, endangered or naturally low in numbers and more research is required in this area in order to improve outcomes for species that may require rearing to support conservation and restoration efforts.

An in-depth desktop search was completed concerning scientific literature in the form of journal articles concerning rearing and toxicity testing of freshwater mussels. Methods included:

- Searching for relevant journal articles through the University of Waikato Online Library
- Speaking with appropriate scientists (see acknowledgements)
- Working alongside NIWA specialists to culture and rear Kaakahi from larval (glochidia) to juvenile life stages

All information was then collated using Google Sheets and this data was then used to write a literature review.

**Hruska Boxes**

The Hruska method for rearing juveniles is well known and documented in freshwater mussel research. For this method, newly transformed juveniles are placed in placed containers with a fine layer or source substrate. Juveniles are left in still water and are only disturbed when cleaning the boxes and observing juveniles. This method can successfully produce juveniles at around a 65% survival rate with 6–12-week-old juveniles. The image below (left side) show a simple Hruska box set up which was completed during this research.

**Flow-through Mucket Buckets**

Mucket buckets have been used to grow freshwater juvenile mussels for several years. Over time the method has been refined and supplemented with mechanisms such as a flow-through filtering system. A flow-through system with mucket buckets is an easy, time-friendly and cost-effective method for rearing juvenile mussels. For this method, a two mucket bucket set up is required along with a recirculating water through. This method can be seen in the image above (right side) and resulted in a 75-95% survivorship rate.
Surgical Decision Making for Women with Breast Cancer
Juanita Raman, Supervised by Tania Blackmore

**BACKGROUND**
- 3572 women were diagnosed with breast cancer in 2020.
- 1 in 9 New Zealand women will develop breast cancer in their lifetime.

Surgical options for Breast Cancer include:
- Breast conserving surgery (BCS) (removal of the tumour or lump)
- Mastectomy (MAST) (removal of the breast)
- Mastectomy with immediate or delayed breast reconstruction (MAST + RECON)

**METHODOLOGY**
- Waikato DHB surgical lists were searched for confirmed breast cancer surgeries
- Participants completed the Breast-Q survey online, via phone or via interview
- Women who gave consent for further contact were interviewed in-depth to further share their stories

**RESULTS**
- 98 women completed the BreastQ survey
- 5% of our sample were unsatisfied with their surgical result
- 4 out of the 5 women who were unsatisfied with their surgical result had undergone mastectomy
- 5% of the whole sample felt unsupported in their surgical decision making. A higher proportion of these women had undergone mastectomy
- 16.3% of our sample would have liked a psychological consult prior to surgery

**DISCUSSION**
- The majority of women in our sample had BCS and were satisfied with their surgeon’s surgical recommendation, their surgery choice and the result
- Women who were less happy with their choice were more likely to have undergone a mastectomy (with or without reconstruction)

**WHY WERE WOMEN UNHAPPY?**
1. The cosmetic outcome
2. Not feeling involved in the decision making process
3. Feeling time pressure to make a decision
4. Feeling uninformed
5. Experiencing poor communication from medical staff
6. Experiencing post-surgery complications

**FUTURE DIRECTIONS**
- The results so far highlight a need for further support for women undergoing mastectomy
- The provision of a psychologist/counsellor may be of benefit to support women through the decision making process

**REFERENCES**
8. Summer Research Scholarship Programme 2021/22
Ecosystem Impacts of Forest Pathogens

**Background**
A pathogen is a disease-causing organism. Forest pathogens are concerning because they often infect keystone tree species. How does the decline of a dominant tree species affect the whole forest ecosystem and the benefits the forest gains from them? What are the direct/indirect effects of these pathogens?

**Methods**
To answer these important questions, we undertook a literature review. Using the web of science literature database, we studied pathogens from all around the globe. *Phytophthora agathidicida* (Kauri dieback) and *Ophiostoma novo-ulmi* (Dutch Elm disease) are but few of the 50+ pathogens studied in total!

**Conclusion**
Big trees like Kauri and Elm provide leaf litter, nesting sites, and protect smaller trees. A reduction in these dominant trees can create large gaps in a forest, impacting plants that need shade, moisture, and nutrients from bigger trees. In the long term, tree decline can offset an entire forest ecosystem.

**Dutch Elm Disease**
Caused by *Ophiostoma novo-ulmi*, it is the most destructive pathogen to Elm trees in the Northern Hemisphere. The fungus has been infecting trees since the 1940s. Symptoms seen on Elm trees include branch death, yellowing, and leaf drop. American Elm tree (*Ulmus americana*).

**Kauri Dieback**
The fungus *Phytophthora agathidicida* causes root rot and leaf drop on the beautiful Kauri tree of Aotearoa. Kauri dieback has been in issue since the 1970s and has since been associated with the massive decline of these native trees. Kauri tree (*Agathis australis*).

**References**
- Joaquina Romera, Poppy Romera, Rebecca Le Grice, Andrew Barnes
- School of Science, University of Waikato, New Zealand
Next-Generation Compliant Blueberry Harvester

Research and Development: Jacob Salisbury
Supervisors: Ajit Pal Singh and Mike Duke

Background
- The fresh picked blueberry market uses manual labour to pick berries due to their fragility and small size
- Blueberry picking is a tedious and excruciating task when performed manually
- Musculoskeletal injuries are very common
- High labour costs and lack of seasonal workers has had a severe impact on the industry
- Existing robotics are too rough for picking blueberries for the fresh market
- Regular mechanisms are often inefficient and complicated, and struggle in outdoors environments

What is a Compliant Mechanism?
- A compliant mechanism uses flexible components in place of pins, hinges etc.
- This results in a much simpler design that weighs less, costs less, and has better performance
- An example of a compliant mechanism would be the cap on a shampoo bottle

The Mechanism

Performance
- Picking individual berries is very inefficient, so this approach would grip the branch and shake the berries off
- Gripper attaches to a UR5e robotic arm
- Through the use of highly compressed air, a pneumatic cylinder generates the clamping force required
- Under 4 Bar of pressure (approximately double a car tyre), 3141.6 Newtons of force is achieved. This is equivalent to 320kg
- From field trials on Eureka First Blush variant blueberries, a shaking amplitude of 25mm at 235 oscillations per minute is ideal

Future Development
- Optimize design to reduce wear and increase life of the part
- Update clamping mechanism to grip branches of various sizes
- Add image processing for detecting ripe berries
- Decrease size for reaching into dense and wildly growing bushes

References
Introduction
Today document classification is generally done using popular methods such as the Bag of Words approach, classifying documents based on the presence or lack of certain words, and Doc2Vec, a deep learning method that represents documents as vectors.

This project aims to find out if an alternative method had any merit. This method would borrow ideas from random forests and utilise text compression to attempt to classify documents in a binary class scenario.

Researcher: Daniel Shepherd
Supervisor: Dr. Tony Smith

Goals
Our goals for this project were:

• Develop an algorithm to perform the necessary operations and provide the data we required to discern if the method worked or not.
• Experiment with different variables for each of the attributes that might affect the accuracy of the method.
• Analyse the resulting data in order to draw a conclusion as to the effectiveness or lack thereof for this potential classification method.

Acknowledgements
I would like to thank Dr. Tony Smith for allowing me to take this project under his supervision and for his guidance and advice, and the University of Waikato for providing these opportunities to students through the Summer Research Scholarships.

Random-zip Text Classification

Figure 1: process to classify a document

Despite multiple approaches to deciding on the class of a document, through average compression sizes and votes based on individual compression results our current data shows no meaningful difference between randomly assigning Test documents to a class and assigning them based on the efficiency of compressed, randomly sampled substrings from known-class documents.

Today document classification is generally done using popular methods such as the Bag of Words approach, classifying documents based on the presence or lack of certain words, and Doc2Vec, a deep learning method that represents documents as vectors.

Figure 2: Research process

This project aims to find out if an alternative method had any merit. This method would borrow ideas from random forests and utilise text compression to attempt to classify documents in a binary class scenario.

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Figure 1 shows the process diagram of the actions our algorithm takes to attempt to classify a document. We randomly sample text from a train file from each class, positive and negative, and compare the compression efficiency when compressing a substring from our unknown test document with each of the train substrings. Whichever is smaller results in a vote being cast for that class. After N repetitions of this process we classify the test document as either positive (in the class) or negative (not in the class) based on the number of votes received.

Designing the algorithm
Outcome of experiments

Figure 1 shows the process diagram of the actions our algorithm takes to attempt to classify a document. We randomly sample text from a train file from each class, positive and negative, and compare the compression efficiency when compressing a substring from our unknown test document with each of the train substrings. Whichever is smaller results in a vote being cast for that class. After N repetitions of this process we classify the test document as either positive (in the class) or negative (not in the class) based on the number of votes received.

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This project aims to find out if an alternative method had any merit. This method would borrow ideas from random forests and utilise text compression to attempt to classify documents in a binary class scenario.

Figure 1 shows the process diagram of the actions our algorithm takes to attempt to classify a document. We randomly sample text from a train file from each class, positive and negative, and compare the compression efficiency when compressing a substring from our unknown test document with each of the train substrings. Whichever is smaller results in a vote being cast for that class. After N repetitions of this process we classify the test document as either positive (in the class) or negative (not in the class) based on the number of votes received.

Despite multiple approaches to deciding on the class of a document, through average compression sizes and votes based on individual compression results our current data shows no meaningful difference between randomly assigning Test documents to a class and assigning them based on the efficiency of compressed, randomly sampled substrings from known-class documents.
The MĀIA machine learning software project is for extracting patterns from Android mobile analytics data. The project is being developed by the University of Waikato and is written in the Kotlin coding language. MĀIA allows businesses to gain valuable insights into consumer behaviour on mobile devices.

**Background**

**Method**

Building the Evaluation Framework
- The metrics for measuring the performance of a model are the model’s build time and classification accuracy
- The evaluation methods to be implemented are k-fold cross-validation and prequential evaluation

Testing the Evaluation Framework:
- The learners with which the framework will be tested are the Hoeffding Tree Learner, Naïve Bayes Learner, and the Zero R Learner
- These learners will be trained on three large datasets that include a range of data types
- The evaluation statistics obtained from these tests will be compared to the results of conducting similar tests using WEKA with cross-validation and MOA with prequential evaluation

<table>
<thead>
<tr>
<th>Time Taken to Build Model (seconds)</th>
<th>WEKA</th>
<th>MOA</th>
<th>MAIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hoeffding Tree</td>
<td>1.85</td>
<td>5.31</td>
<td>4.61</td>
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<tr>
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<td>2.13</td>
<td>0.89</td>
</tr>
<tr>
<td>Zero R Learner</td>
<td>0.05</td>
<td>1.19</td>
<td>0.3</td>
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</table>

<table>
<thead>
<tr>
<th>10-Fold Cross Validation Classification Accuracy</th>
<th>WEKA</th>
<th>MAIA</th>
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</thead>
<tbody>
<tr>
<td>Hoeffding Tree</td>
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<td>68.07 %</td>
</tr>
<tr>
<td>Naïve Bayes</td>
<td>63.26 %</td>
<td>62.04 %</td>
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<tr>
<td>Zero R Learner</td>
<td>55.46 %</td>
<td>60.78 %</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Prequential Evaluation Classification Accuracy</th>
<th>MOA</th>
<th>MAIA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hoeffding Tree</td>
<td>65.08 %</td>
<td>69.25 %</td>
</tr>
<tr>
<td>Naïve Bayes</td>
<td>64.55 %</td>
<td>58.05 %</td>
</tr>
<tr>
<td>Zero R Learner</td>
<td>55.46 %</td>
<td>55.46 %</td>
</tr>
</tbody>
</table>

*Note: this is only the results from one of the datasets

**Results**

**Conclusion**

From the results observed throughout this research project, MĀIA appears to be performing similarly to WEKA and MOA. During this research project, the evaluation framework has been created, and more machine learning algorithms have been added to MĀIA. A public release of the software is expected to be out soon.

Samantha Steed, Albert Bifet, Corey Sterling
School of Computing & Mathematical Sciences, University of Waikato, New Zealand
DNA Repair from Antarctica

Ronja Stelzer. Supervisors: Adele Williamson & Elizabeth Rzoska-Smith
School of Science, University of Waikato, Hamilton, NZ

**DV1-1 nuclease from McMurdo Dry Valleys**

**Methods**

- **DV1-1 nuclease shows nuclease activity**

**Into the future with EXTREMOZYMES**

- Extremozymes catalyse reactions under extreme conditions. This opens applications of biocatalysts replacing existing chemical catalysts. Extremozymes are environmentally friendly, efficient and sustainable.

**References:**


We hypothesize that bacteria from Antarctica have more advanced DNA repair systems compared to mesophiles.
**INTRODUCTION**

The interest around automated harvesting is increasing due to the worker shortage and the labour-intensive nature of harvesting. However, there are limitations regarding how well the machines can detect the crops under real-world conditions.

**OBJECTIVE**

The aim of this project is to develop a machine learning model to detect rock melons in a real-life scenario (1) with a precision of at least 80%.

**METHOD**

A rig (2) was developed to capture the dataset. The image dataset was labelled and trained using a Mask RCNN model (3). The dataset captured was split into 70% train, 15% validation and 15% test (3) to ensure an accurate model.

**RESULTS**

A mean average precision (mAP) of 0.887 means the model can accurately identify a rock melon (4). The mean average recall (mAR) is an equally important metric. It indicates the proportion of rock melons detected. An mAR of 0.659 means that it would fail to detect some melons (4). This area needs improving before deploying the model.

**CONCLUSION**

The current machine learning model proves to be a good start towards autonomous harvesting of rock melons. Future work would include refining the model to increase the accuracy of the model and the localisation of the detected rock melons.

**ACKNOWLEDGEMENT**

A special thanks to Sean from Moffett Orchards for letting us go to his rock melon farm to capture the images for the dataset.
The issue:
Lakes of Aotearoa are of significant cultural, social and economical value. Many of Aotearoa’s shallow, urban and monitored lakes are degrading and in a eutrophic state. Of the 127 lakes monitored, 55% are in poor or very poor condition [1]. Eutrophication of lakes is a major problem threatening the ecosystems and species they support as well as increasing the prevalence of toxic algal blooms, preventing social and recreational enjoyment. With increased sedimentation and spread of invasive species, these lakes have poor water quality and native macrophyte coverage are in decline.

Methods:
• 10-15 cm apical shoots of 5 native macrophyte species were grown in a small pots with either topsoil or lake sediment. Pots were placed in tanks heated at either 15, 20, and 25°C. Plant growth was monitored and height recorded fortnightly over a 8-week period.
• Species selected: Nitella aff. cristata (N), Potamogeton cheesemanii (PC), Myriophyllum triphyllum (MT), Myriophyllum propinquum (MP), Potamogeton ochreatus (PO)

Preliminary results:
• Most species had optimal growth in the lake sediment (PC, MT, MP) and in 20–25 degree water.
• Overall, Potamogeton cheesemanii (PC) grown in lake sediment at 20 degrees had the greatest growth over the trial period.

Discussion:
From this trial we can see sediment and temperature are important factors influencing plant growth. Also, results suggest plant response varies greatly between native species. These findings will help identify which native macrophytes will be best suited to specific lake conditions for restoration. Results will lead on to further trials and help predict how quickly a species will potentially grow in various lake substrates and what size a plant may need to be to successfully reestablish in various lake environments.

Our aim:
Aquatic macrophytes are important components of lake ecosystems. Macrophytes help stabilize sediment, uptake nutrients and improve water quality. Macrophytes also provide valuable habitat and food for invertebrates, wildlife and fish. To improve native biodiversity native macrophytes need to be re-established. Little is known about how to restore native macrophytes under different environmental conditions. To successfully restore macrophytes into lakes and improve water quality we must understand the plant requirements including growth response in varying lake environmental conditions, this is investigated in our study.

Acknowledgements:
Due to the time of publishing the results are based on 6 weeks results. Thank you to Te Kūwaha for the great opportunity along side my supervisors from NIWA and the University of Waikato. Project gratefully funded by NIWA (END21211).

Reference:
SOIL PH CHANGE

CAN A CARBON CAPTURE TECHNOLOGY MATCH THE PH EFFECT OF LIMING ON PASTURE?

BACKGROUND
Enhanced rock weathering (ERW) is a new carbon capture technology. The process involves mixing pulverised rock dust into topsoil, where it then reacts with rainwater to form a clay.

ERW is a financially and logistically viable option for capturing atmospheric CO2 on a large scale. An additional effect of this reaction is that it increases the pH of the surrounding soil. For this research, dunite (igneous rock) is used.

Liming describes the spreading of calcium carbonate onto pasture to raise the pH of acidic soils.

CONCEPT
Enhanced rock weathering has yet to be tested in the field, and its true effect on pH is unknown. It is also currently an expensive process to conduct. If dunite is able to match the liming effect on pH, as well as capture significant amounts of carbon, then this may help incentivise farmers to adopt dunite application onto their pasture and forego liming.

WHY DUNITE?
- Fast weathering rate
- Abundant in New Zealand
- Best choice for ERW

95Gt 4.9Gt
potential CO2 removed per year

$88 $294
approx. cost to remove CO2 per tonne (NZD)

METHODS

FIELD DEPLOYMENT

TWO SITES FOR THE TRIAL
TILLING
APPLICATION LIME: 1 TONNE/HECTARE DUNITE: 20 TONNES/HECTARE
CAPTURE + PH CHANGE

LAB ANALYSIS

PH MEASURING SOIL ACIDITY
OVEN DRYING SOIL WATER %
ACID LEACHING ORGANIC MATTER %
MASS SPECTROMETRY MAJOR & TRACE ELEMENTS + CARBON CAPTURE RATE

RESULTS

KEY POINTS
- Initial greater pH increase for dunite plots than lime
- Dunite plots decrease in pH after initial increase
- Lime pH data more varied
- Net pH change of +0.11-0.23 for dunite plots
- Net pH change of +0.09-0.23 for lime plots
- Dunite & lime treatments produced similar pH at the end of trial

CONCLUSION
Dunite and lime treatment have a similar capacity for pH change in soil. Lime plots appear to be more affected by environmental stresses, whereas the dunite had a better buffer capacity. As pH is affected by many factors, it must be recognised that the treatments are not solely responsible for the pH change in the soil.

REFERENCES
Macrocystis are efficient at up-taking nutrients from the water and thus can be used for bioremediation\(^1\). Growth of macroalgae often correlates with nutrient removal, therefore ensuring high growth rates generally leads to higher rates of bioremediation. Light and temperature are the main parameters affecting algal growth and nutrient uptake but are costly and hard to control in aquaculture\(^2\). Therefore, finding a species that maintains high growth rates in year-round environmental conditions is essential for effective bioremediation.

To determine the effects of high temperature and light intensity & low temperature and light intensity on growth and photosynthetic performance of three macroalgae species identified as targets for land-based aquaculture - *Ulva* sp. B (marine), *Ulva ralfsii* (marine), *Oedogonium* (freshwater)

### Methods

Three experiments of 12 days each under varying temperature and light conditions were conducted. For each experiment:
- 6 replicates per species maintained in gently aerated 250ml flasks with nutrient enriched water
- Harvested and weighed every 4 days
- Maintained under controlled temperature and light intensity, replicating summer and winter conditions.

### Results

- **Experiment 1** = 2°C, low light intensity, 8hrs light, 16hrs dark
- **Experiment 2** = 7°C, low light intensity, 8hrs light, 16hrs dark
- **Experiment 3** = 23°C, high light intensity, 16hrs light, 8hrs dark

### Key findings

**Growth:**
- All species maintained high weight at 23°C but declined in weight at 2°C
- *Ulva ralfsii* grew 2.4 times more than both *Ulva* sp. B and *Oedogonium* at 23°C
- *Ulva ralfsii* was slower to decline in weight compared to the other species at 2°C

**Photosynthetic performance (not displayed):**
- All species declined in photosynthetic performance at 2°C with *Ulva* sp. B declining the most
- There were no effects on photosynthetic performance for all three species at both 23°C and 7°C

### What does this mean?

Algae bioremediation using these species is ideal in areas where temperature doesn’t get below 7°C to ensure no decline in growth and/or nutrient removal. *Ulva ralfsii* appears to be more tolerant than *Ulva* sp. B to low temperatures and light intensity as it didn't decline in weight as quickly. A 28°C experiment with high light intensity is currently underway. Results are expected to show a decline in weight as 28°C is above temperatures that are experienced in the natural environment.

### References

Karen Turanga
Division of Health, Engineering, Computing and Science

Barriers to Dental Care for Patients with Valvular Heart Disease
Karen Turanga, supervised by Prof. Ross Lawrenson
Te Huataki Waiora School of Health, University of Waikato, New Zealand

Introduction
Research to discover the barriers faced in receiving dental care is important in valvular heart disease patients. Valvular heart disease can be fatal if left untreated, often requiring the damaged valve to be replaced. Damaged or replaced valves are vulnerable to bacterial endocarditis, an infection within the heart, caused by bacterial pathogens traveling through the bloodstream. Poor oral health and recent dental treatment are a major risk factor (1). This controllable risk factor is often neglected, resulting in poor oral health in patients with heart disease (2). Waikato District Health Board (DHB) funds dentistry for patients with established valvular heart disease requiring surgery and provides hospital-based dental treatment in acute cases. In general, dental treatment will be completed prior to valvular surgery at Waikato DHB; this research hopes to understand what barriers are faced by patients and how they can be mitigated in future.

Aim
Describe barriers to dental care for patients with valvular heart disease by:
• establishing the current dental status of patients with valvular heart disease
• understanding the range of dental treatment and costs provided by Waikato DHB
• describe barriers patients face in accessing dental care

Methods
Phase One
• Obtain ethical approval for the study
• Obtain data from the cardiothoracic unit at Waikato DHB and cross-reference with clinical records and additional data from Strategy and Funding in 2019 and 2020
• Determine the valvular surgical treatment received by Te Manawa Taki patients
• Determine patient dental health status and treatment provided

Phase Two
• Interview participants to better understand the barriers they face

Results
Demographics:
• 362 patients aged 21 – 83 years were identified
• 51% Waikato, 33% BOP, 10% Lakes & 6% Taawhiti DHBs
• 65% male, 35% female
• 67% urban, 33% rural
• 72% NZ European, 24% Māori, 2% Asian, 1% Pacific peoples, 1% Other

Key Findings
• The range of valve replacements included mitral valve, aortic valve, and tricuspid valve
• Clinical dental records were reviewed for referrals and treatment compared with surgical dates
• Valvular surgery pre-operative and post-operative infective endocarditis was noted
• No dental treatment records were found for 38% of Waikato DHB valvular surgery patients

Discussion – preliminary findings
Based on the initial 100 patients identified:
Endocarditis across all DHBs
• 12 pre-op and 3 post-op endocarditis were noted
• Significantly, 10 pre-op and all 3 post-op endocarditis were Māori
• An additional case of secondary sepsis was also Māori
• Four patients were deceased within three months of treatment

Dental
• 22 Waikato DHB patients had dental referral or treatment noted in their clinical records with 5 having DHB funding
• Waikato DHB dental department has consistently made patients surgically fit within surgical timeframes on referrals
• There were 16 valvular surgery Te Manawa Taki patients, 11 from Waikato DHB district, referred to Waikato DHB dental department.
• One treatment was extended due to patients poor oral condition
• Of 29 community dental treatment records, 11 were from Waikato DHB

Conclusion - preliminary
While the Waikato DHB has recognised the need for good oral health prior to valvular surgery, and have policy funding in place, there appears to be an opportunity to improve the systematic recording, assessment and pathways to achieve this. Improvements would also aid any funding recovery required from other DHBs.

References
Unique Sulfur Acquisition Mechanism in a Bacterial Pathogen
Jessica Usu, Dr. Joanna Hicks & Stacy van Niekerk

Background
This is gonococcus a bacterial pathogen that is sexually transmitted and causes the stigmatized infection gonorrhea. It is a leading global health problem due to the emergence of antibiotic resistant strains.

Sulfurtransferase
PspE is the unique enzyme responsible for producing cysteine and is 15.279kDa in size.

Problem
The unique mechanism to produce cysteine and other sulfur containing biomolecules, which are crucial for infection and protection from oxidative stress in a host, are still a mystery and so we have characterized PspE to better understand its role.

Aim
Biochemically characterize the sulfurtransferase PspE in Neisseria gonorrhoeae (gonococcus).

Methods & Results
Pure form of PspE for characterization included optimizing expression in E. coli BL21. Assays done manually by spectrophotometer.

Fig.1. Successful crystal screen with needle highlighted, needed to determine
Fig.2. The plot above proves that our enzyme PspE has substrate specificity for our substrate thiosulfate and glutathione.
Fig.3. Data indicated that lower concentration of enzyme turned over more product with a higher concentration of thiosulfate.

Conclusion & Recommendation
PspE is an active functional sulfurtransferase that utilizes thiosulfate and glutathione as a substrate to acquire sulfur for the biosynthesis of cystine. It is therefore recommended for future studies that a deletion strain of PspE be generated with erythromycin resistant gene in lieu of the PspE gene to detect if no activity takes place.
As the human population increases, so does the demand on food producers. One way New Zealand can meet the food demands of the future is with Aquaculture, the cultivation and harvesting of marine organisms. Aquaculture in New Zealand is currently a $600M industry, and is predicted to grow to be worth $3B by 2035 (2). Green shell mussels make up a significant percentage of the industry in NZ, so their shells are an abundant waste product. With growth in production comes growth in waste production, so utilising this waste is potentially very valuable. One way to do this is using the shell as plastic filler, which can improve plastic foaming.

**Background**

The dry mussel shell fragments from an aquaculture farm are ground up into a fine powder before being mixed into the plastic matrix as a filler. Polyethylene pellets are dried and mixed together with mussel shell powder.

The mussel shell powder and dried polyethylene pellet mixture is fed into the extruder via a hopper. Screws in the machine mix the 2 materials together, while heat is supplied to the extruder barrel, causing the polyethylene to melt and mix with the shell powder. The resulting composite is forced through the die at the end.

The composite is granulated once more, then mixed with a small amount of bicarbonate. The mixture is fed into the extruder. The heat melts the composite powder, and causes the bicarbonate to thermally decompose, producing CO2 gas. This gas creates large bubbles or cells in the composite, turning it into a foam once it exits the extruder.

**References**


Activity of DNA Ligases on Non-Canonical Substrates

Caitlin Walters-Freke and Dr Adele Williamson
School of Science, University of Waikato, New Zealand

Background

A DNA Ligase enzyme, like T4 (Fig 1), forms a phosphodiester bond between adjacent 5’ P and 3’ OH in the backbone of DNA. Natural bases pairs in DNA are A-T and C-G. Unnatural Base Pairs (UBPs) are bases which obey Watson-Crick pairing rules and differ by rearranging the hydrogen bonds. Examples include S-B and P-Z (Fig 2). Expanded genetic alphabets featuring UBPs can potentially encode new amino acids in synthetic biology.

The aim is to compare the activity of a structurally-diverse range of DNA ligases with unnatural base pairs.

Method

1. Denature the Ligase and DNA
2. Urea Page Gel Electrophoresis
3. Each enzyme was tested with UBP substrates (Fig 4) using a Urea-PAGE assay (Fig 3). The gels were quantified by measuring the intensity of the bands.

Results

Figure 4. The S-B and P-Z substrates.

Figure 5. An Example of Urea Page Gel with Lig 3 and the S-B substrates at 10x dilution and an Example Bar Graph Quantifying the Bands in this gel.

Conclusion/Next Steps

- Lig 5 and Lig 12 have very high levels of activity
- Lig 9 has the lowest levels of activity
- Next steps will include further characterization of these enzymes as well as testing the UBPs with other proteins.
- If DNA Ligases can join DNA with UBPs then there is potential to clone DNA with UBPs and encode for proteins not seen in nature.

References


Special thanks to the University of Waikato Summer Research Program and Dr Adele Williamson for giving me this wonderful opportunity.
How do mānuka and kānuka partition landslide environments?
Melissa White & Chris Lusk (Environmental Research Institute)

Introduction

- Mānuka (Leptospermum scoparium) and kānuka (Kunzea ericoides) are widespread native trees that colonize early successional environments such as landslides.
- Although they both display similarities in physiology and habits (Fig. 1), differences have been observed regionally. Mānuka tolerates poor drainage and nutrient content while kānuka has a greater tolerance for drought but requires more nutrients (Wardle 1991)¹.

This may also occur on local scales such as on landslides, thus allowing co-existence of the two. Therefore, we hypothesized that (1) manuka would be better suited to the erosion (source) zone and (2) kanuka to the deposition zone (Fig. 2).

Methods

- We measured the abundance of both mānuka and kānuka at seventeen landslide sites throughout the mid to lower North Island (Fig. 3).

Results

Figure 1. Mānuka (left)² vs kānuka foliage (right)³.

Figure 2. Species on landslide (left) and landslide morphology (right)⁴.

Figure 3. Site locations.

Figure 4. Mānuka and kānuka show similar patterns of density in both landslide environments despite competitive differences as shown above and reflected by the non-significant p-values.

Conclusions

- Our hypotheses around landslide partitioning were not supported according to our results, showing that patterns of density were similar in both zones despite their differing environmental requirements (Fig. 4).
- Future studies may benefit from a larger data pool, i.e. more sites for a greater representation and separate measurements of environmental variables such as soils for the erosion and deposition zones.

Acknowledgements

We would like to thank our field team members Danielle Le Lievre and Moari West along with The University of Waikato, the Environmental Research Institute and our sponsor the Marsden fund for their effort and contributions towards the project.

References

Spatiotemporal Modelling of Burglaries in Kirikiriroa

Jing Yu  Supervisor: Paul Brown

Introduction

In this project, we focus on modelling burglaries over space (spatial) and time (temporal) in Kirikiriroa. We model the intensity of residential burglaries using eight weeks of data and use this to predict burglary activity for the following week. As a model assumption, we use the repeat/near repeat theory [1] which states that the likelihood of a burglary in a specific location depends on very recent burglary activity in the corresponding neighbourhood. We use computational Bayesian methods to perform the inference and estimations. One advantage of the Bayesian methods is the ability to incorporate expert beliefs with the data. This allows us to set the spatial correlation range and time correlations to values that have been found in other studies.

For modelling burglaries in Kirikiriroa, the space dependencies (or correlations) are not constant. Geographic features (or “barriers”) such as a river mean that spatial correlations do not extend to the other side of the barrier. We take this assumption into account by implementing a geographic barrier as a hole in a spatial polygon representing the space of Kirikiriroa (see Fig. 1). The barriers we have chosen to apply in this model is the Waikato River and Lake Rotoroa.

As a model assumption, we use the repeat/near repeat theory [1] which states that the likelihood of a burglary in a specific location depends on very recent burglary activity in the corresponding neighbourhood. We use a Bayesian algorithm known as Integrated Nested Laplace Approximations (INLA) [2]. Other Bayesian methods are available, however INLA performs computations more efficiently with good accuracy. INLA uses a combination of mathematical methods and a triangulated mesh to “discretise” the space and perform the computations [3]. See Fig. 2 for an example of the triangulated mesh.

Data and Methods

We use eight weeks of residential burglary data within the administrative boundaries of Kirikiriroa, where each observation has a geographic coordinate (northing and easting), and a time (week, from 1 to 8). The dataset is shown in Fig 1.

We use a Bayesian algorithm known as Integrated Nested Laplace Approximations (INLA) [2]. Other Bayesian methods are available, however INLA performs computations more efficiently with good accuracy. INLA uses a combination of mathematical methods and a triangulated mesh to “discretise” the space and perform the computations [3]. See Fig. 2 for an example of the triangulated mesh.

Model

We have the following general additive model:

\[ \eta_i(t) = \beta_0 + f_{x}(w_i), \]

\[ i = 1, ..., n \quad t = 1, ..., 8 \]

Where:

- \( i \) is a location, and \( t \) is a time (week)
- \( \beta_0 \) is the estimate of intensity
- \( \beta_x \) is the intercept
- \( w_i \) is an observed location
- \( f_{x} \) is a spatiotemporal function consisting of the Matérn correlation function and an autoregressive model of order 1.

Acknowledgements

We would like to thank the University of Waikato Summer Research Scholarship for funding this research, and Waikato Police for the data.

References


Results

Fig.3 represents the fitted model from the eight weeks of residential burglaries observed. The red colour shows the highest intensity of burglaries, with dark blue representing relatively low intensity. Northern Kirikiriroa suburbs generally saw little to no burglary activity, whilst there were clusters of burglaries in Hamilton East, Bader, and the CBD.

We show the results for the predictions of Week 9 using hotspot maps in Fig. 4. The areas shaded red represent the hotspots – the highest predicted intensities, and we provide the top 1%, 2.5%, 5% and 10% hotspots. Also shown on the maps are the observed burglary locations. We see in the hotspot maps that most of the crime predicted is in the Hamilton East area close to the University, with some in Bader, CBD and Nawton.

The table below gives the prediction results.

<table>
<thead>
<tr>
<th>Hotspot</th>
<th>1%</th>
<th>2.5%</th>
<th>5%</th>
<th>10%</th>
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<tbody>
<tr>
<td>% Predicted</td>
<td>7%</td>
<td>14%</td>
<td>16%</td>
<td>23%</td>
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</tbody>
</table>

Future Work

This model takes into account space and time correlations, as well as geographical barriers. However, there are other factors that can be used to model crime. Socio-economic factors such as deprivation and income have not been considered in this study. We also came across issues with the model predicting higher around boundaries than expected.

Future work will try to incorporate significant socio-economic factors and to fix the boundary issues we have encountered by reconfiguring the mesh.
Can Entrepreneurs Read Minds?

INVESTIGATING EMOTIONAL ACCURACY AND ENTREPRENEURIAL SUCCESS

Why?

Why is it that some entrepreneurs are able to consistently identify opportunities and capitalise on them, while others fail?

- Entrepreneurial success comes down to the decision-making process "entrepreneurial judgement." This process is ill-defined and cannot be pinpointed.
- Being able to identify specific traits that predict higher success rates will benefit businesses, investments, and training.

What?

- Cognitive empathy: The ability to perceive another’s emotions through problem-solving
- Affective empathy: The ability to feel someone else’s emotions
- Three self-reported empathy scales, an entrepreneurial success self-reported questionnaire (SES-AS) as well as profit margin and growth to identify correlations between each of these measures. Data was gathered from 157 entrepreneurs worldwide.

Results

- We observed a consistent, small but statistically significant positive relationship between cognitive empathy and entrepreneurial success.
- This includes being able to see things from other points of view, imagining others' experiences, and using problem-solving to identify how others think.
- We also observed a weak negative correlation between affective empathy and entrepreneurial success.
- A unusual but significant correlation was seen between personal distress and growth rate, suggesting a relationship with poor levels of emotional resilience and organisational growth. This might be due to higher levels of perfectionism or dissatisfaction with current levels of success.
- I now hypothesise that rather than entrepreneurial judgement being empathetic accuracy, that it is specifically cognitive empathy that increases entrepreneurial success, with affective empathy having a slightly negative correlation.

Next?

- This work is providing evidence to McMullen’s hypothesis of "entrepreneurial judgement" being empathetic accuracy or cognitive empathy and can help us better understand the entrepreneurial decision-making process.
- Future research would be to develop an experimental study to confirm causation.

Scan here for details, results and references.
Can uncertainty provide certainty?

Keruma Gibson  Supervisors: Dr Vijay Kumar (lead) and Dr Nirosha Hewa Wellalage

Introduction
Economic policy uncertainty (EPU) is an increasingly popular tool in economic analysis. However, its impact on economic growth is still unclear.

This research attempts to assess how EPU affects economic growth and its usefulness as a predictor for the latter. The Asia-Pacific region is used for this analysis.

Method
Data from Baker et al.’s EPU index1 and the World Bank2, 3 were used in multivariable regressions.

GDP growth served as a proxy for economic growth and was the dependent variable. There were 13 independent variables in the final data: annualised national EPU values, six governance indicators (WGI), and six financial development indicators.3

Results
Table 1 showing key results from multivariable regressions against GDP growth.

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
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<tbody>
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<td>EPU</td>
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<td>-0.009 (3.89)**</td>
<td>-0.006 (3.20)**</td>
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<td>-0.007 (3.21)**</td>
<td>-0.007 (3.28)**</td>
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<td>Lending Interest Rate</td>
<td>0.763 (5.10)**</td>
<td>0.718 (5.65)**</td>
<td>0.679 (5.72)**</td>
<td>1.010 (5.33)**</td>
<td>1.198 (5.73)**</td>
<td>1.091 (5.55)**</td>
<td>1.198 (5.73)**</td>
</tr>
<tr>
<td>Inflation</td>
<td>-0.063 (0.37)</td>
<td>-0.063 (0.37)</td>
<td>-0.063 (0.37)</td>
<td>-0.063 (0.37)</td>
<td>-0.063 (0.37)</td>
<td>-0.063 (0.37)</td>
<td>-0.063 (0.37)</td>
</tr>
</tbody>
</table>

Note: Results in parentheses are robust t-statistics and ** indicates significance at 1%.

Table 1 shows that EPU has a negative impact on economic growth which is in line with the previous literature. This posits that greater uncertainty leads to reduced investment and thus decreased growth.

Political stability has a positive impact on economic growth. This also aligns with expectations as greater political stability fosters more trust and investment in an economy.

Increases in lending interest rate lead to an increase in economic growth.

Meanwhile, inflation does not have an impact on GDP growth.

Conclusion
The findings of this research support the theoretical hypothesis that EPU and economic growth are inversely related. They also provide credence to the use of EPU as an indicator of economic growth. Further research avenues include assessing the ability of EPU to gauge the magnitude of economic growth changes, employing time delays in regressions, and testing these findings in other areas of the world.

References

Acknowledgments and thanks to my supervisors, Dr Vijay Kumar and Dr Nirosha Hewa Wellalage, for their guidance with this research and to the University of Waikato’s Summer Research Scholarship Programme for this opportunity.
Does drought affect farmer well-being?

Caroline Kolver
Waikato Management School

Introduction
The severity and frequency of adverse weather effects have increased in recent years, for example, 2021 was New Zealand’s warmest year on record continuing a pattern of “warmest year” for 7 out of the past 9 years (NIWA Climate Summary, 2021). The agricultural and horticultural communities that make up 5.9% of the workforce are having to adapt and prepare for these impacts. However, increased adverse weather events have been shown to be negatively associated with farmer well-being.

We wanted to know specifically how summer drought affects farmer well-being in New Zealand. Our hypothesis was that farmers located in districts with higher drought index averages would have lower well-being, as a response to the long-term consequences of adverse weather events. These consequences might include production losses due to low crop yield, underweight livestock and lower conception rates.

Method
The Survey for Rural Decision Makers (Landcare Research 2021) allowed for a high level of data collection with 6,717 responses between June – August 2021. The well-being question was asked on the basis of the World Health Organisation’s Five Well-being Index. It includes a short questionnaire of 5 questions to give a score between 0-25 (low to high) from which district averages were calculated.

The New Zealand Drought Index (NZDI; NIWA, 2021) is based on a combination of rainfall, soil moisture deficit and anomaly, and potential evapotranspiration deficit. NZDI data was sourced from an index chart (NIWA, 2021) between 1 December 2020 – 31 March 2021 (NZ summer period), and district averages established. Data was cleaned using RStudio, removing “not applicable” responses, and lifestyle farmers (as their farms were not their sole source of income).

The research question was addressed by a linear regression using OLS

\[ y_{ij} = \alpha + \beta x_i + \delta z_i + \epsilon_{ij} \]

Two models were used to examine the association between NZDI and well-being, with Model 2 including control variables gender, age education, industry, farm size, and profitability.

Results
The NZDI heat map (Figure 1) was highlighted as expected, with districts in the North experiencing severe drought indicated by red (0.81-1.1). Districts in orange, predominantly in the North Island represent extreme dryness (0.51-0.8). Regular soil dryness (yellow, 0.21-0.5) is shown by the majority of the South Island, while green (<0.1-0.2) displayed no drought covering the West Coast districts.

The orange range (14.1-16.0) on the well-being heat map (Figure 2) includes the average score of 15.3. Very low well-being (red, 12.0-14.0) can be seen in Wellington, Wairarapa, Ashburton, and Mackenzie districts, while high well-being (green, 18.1-20.0) is evident in Tauranga and Napier cities.

Discussion
There may be a number of reasons for the lack of a relationship between recent drought and farmer well-being. Districts most prone to drought may have implemented strategies such as irrigation, lower stocking rates, and additional supplementary feed (which wasn’t reported on in the survey). Respondents living in areas of drought (red) may have chosen that district for the climate, an example of this being horticulturalists who thrive in dry conditions. The low well-being in the West Coast, Ashburton and Mackenzie districts do not correlate with NZDI data, however extreme flooding in May and July 2021 for these areas just before and during the survey may explain the low well-being response. Despite a meteorological drought recorded in the Far North district, as well as extremely dry conditions for most of the North Island, it wasn’t reflected in the well-being scores. We may speculate that farmers in these regions are becoming more prepared for these climate changes and are future-proofing their systems.

References
Climate change worry negatively affects farmer wellbeing.

Introduction

Climate change has become a dominant discussion within the world and public concern regarding climate change and its effects is prominent and has recently increased (Moss et al., 2021). The changing climate has great impact on weather conditions and temperatures which affect the productivity and operations of the agricultural industry. Uncertainty about future climate conditions can cause farmers to become concerned about the future of the farming industry. This may lead to climate anxiety, which causes great distress and impairs typical functioning (McBride et al., 2021). This study examines the question that will be analysed is “Do beliefs about future climate change affect farmer wellbeing?”. This research will investigate the beliefs and concerns farmers have regarding climate change and whether climate change worry greatly impacts farmers health and wellbeing.

Method

The data for this research comes from the Survey of Rural Decision Makers (SRDM) which is conducted by Manawatu Whenua Landcare Research (MWLR) and the data analyses over 1900 commercial farmers, foresters and growers across NZ. We estimate a linear regression using OLS and this will be used to determine the hypothesis that farmers who have high or moderate worry about climate change have lower wellbeing scores compared to farmers who have low worry. The regression model includes the main independent variables moderate and high climate change worry. To measure these variables farmers are asked in the SRDM about the impact climate change has on the operations of their farm, forestry block etc. If they answer very highly or highly they are categorised under ‘high worry’ and if they answer ‘somewhat’ or ‘not at all’ they are categorised under low worry. The dependent variable well-being is measured using the WHO-5 scoring system and the control variables include age, gender, education, profitability, industry, and farm area. Following is the regression equation which has been developed.

\[ y_i = \alpha + \beta_1 x_{i1} + \beta_2 x_{i2} + \beta_3 x_{i3} + \epsilon_i \]

The dependent variable \( y_i \) is the WHO-5 (well-being) score for individual \( i \). Term \( \alpha \) is an intercept. The variables \( x_{i1} \) and \( x_{i2} \) are moderate and high levels of worry about climate change, and \( \beta_1 \) and \( \beta_2 \) are their coefficients. \( x_{i3} \) represents all the control variables combined and \( \epsilon_i \) is an individual error term. The results of the regression are presented in the following table.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficients</th>
<th>Standard errors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate worry</td>
<td>0.040**</td>
<td>0.018</td>
</tr>
<tr>
<td>High worry</td>
<td>0.008</td>
<td>0.008</td>
</tr>
<tr>
<td>Female</td>
<td>0.063</td>
<td>0.032</td>
</tr>
<tr>
<td>Certificate or Diploma</td>
<td>0.019</td>
<td>0.018</td>
</tr>
<tr>
<td>Age</td>
<td>0.040**</td>
<td>0.018</td>
</tr>
<tr>
<td>Marital status</td>
<td>0.063</td>
<td>0.032</td>
</tr>
<tr>
<td>Farm size (ha)</td>
<td>1.406</td>
<td>0.229</td>
</tr>
<tr>
<td>Farm tenure</td>
<td>1.309**</td>
<td>0.489</td>
</tr>
<tr>
<td>Net profit</td>
<td>1.326**</td>
<td>0.432</td>
</tr>
<tr>
<td>Dairy</td>
<td>-0.092</td>
<td>0.153</td>
</tr>
<tr>
<td>Unprofitable</td>
<td>-0.505</td>
<td>0.415</td>
</tr>
<tr>
<td>Profitability</td>
<td>0.307</td>
<td>0.286</td>
</tr>
<tr>
<td>Area (ha)</td>
<td>0.008</td>
<td>0.008</td>
</tr>
<tr>
<td>Convenor</td>
<td>15.155**</td>
<td>6.079</td>
</tr>
</tbody>
</table>

**Observations:** 517, Adjusted R²: 0.02 of model. Non-standard errors in parentheses.

Discussion

By running the regression model we have discovered that there is a strong relationship between the main independent variables moderate and high worry and wellbeing. We have found that the main independent variables are significant and support the hypothesis that farmers who have moderate to high worry about climate change are expected to have lower wellbeing than their low-worry counterparts. There is a low percentage of high worry farmers with a majority of farmers being categorised under low worry. This could be partly due to the age factor. With the majority of farmers being older individuals they may have lower ‘future orientation’, are less concerned about future climate change effects and therefore have higher well-being. While younger farmers have a high regard for the future, and many will be alive to see the more severe outcomes of climate change. It can be expected that younger individuals may have greater climate change concerns (McBride et al., 2021).

References


Acknowledgements

Many thanks to Zack Cramer, Pika Stahlmann-Brown from MWLR and the University of Waikato. 

Author: Te Rehia Ratu
Solar energy is a rapidly growing technology that is continuing to decrease in cost and therefore increase in availability (Figure 1). Given the recent trends in solar system costs and the introduction of sustainability goals set by the New Zealand Government, solar energy is becoming a major participant in the conversion from fossil fuels to renewable energy sources.

The aim of this research is to evaluate whether solar PV systems are an economically viable investment as an energy source for schools in New Zealand.

From the study we can conclude that the return on investment (ROI) is lower when the output of the system does not match the energy demands of the school. Excess energy leads to the need for expensive storage systems or requires selling energy back to the grid at a lower rate than current electricity prices. Findings were calculated based on the output of systems at recommended sites. However, better analysis could be made if system choice was based on active consumption. However, data on energy demands for each school was not publicly available. Data on electricity consumption from schools is difficult to collect as the majority of schools are closed over the December to January period. Therefore, this research could have been better conducted during the school period.

On average, schools from the study could expect to save from $9000 up to $12000 per annum on electricity costs. Actual savings will depend on the proportion of energy consumed as an alternative to purchasing electricity and the proportion sold to the grid for a nominal price.

NPV:
The price of battery systems had an effect on NPV calculations.

NPV for a 10kw system with a lithium ion 12kWh Battery system was negative (-$3,121.88) with a payback period greater than the lifetime of a solar panel 27.528 years.

NPV for a 10kW system without a battery system was positive ($10,878.12) with a payback period of 14.018 years.

Therefore, solar systems are a viable investment for schools given they minimize battery expenses and either consume or donate energy back to the grid as opposed to storage.

Knowledge is Power - Power for Knowledge

Evaluating the performance of Solar PV systems in New Zealand Schools

Dr. Mark Lay, Dr. Geeta Duppati, Danielle Bertram and Marcus Ridgway

University of Waikato, New Zealand.
Resilient Distribution of Consumer Goods in New Zealand: A Study of Redundancy and Flexibility in the Wake of a Natural Disaster

Introduction

Severe weather events expose the fragility of supply chain (SC) networks. These natural disasters lead to damaged public infrastructure (i.e., roads and rail) and shortages of consumer goods on the shelves of supermarkets. However, research on SC resilience and the ability of retailers to deal with these risks are limited. The importance of resilience (redundancy and flexibility) leads to the development of the research question below to address this issue.

How New Zealand supermarkets deal with supply chain disruptions in the wake of a natural disaster?

Definitions

Resilience

The ability to recover from an unexpected or unforeseen event.

Flexibility

The ability to quickly adapt operations in the aftermath of a disturbance (e.g., the use of alternative roads for transporting goods)

Redundancy

Excess capacity held as a cushion to reduce the effects of an unforeseen event, also known as buffer inventory or safety stock.

Objective

This study aims to assess the resilience of New Zealand’s replenishment systems for supermarkets and grocery stores in the wake of a natural disaster. Based on the concepts of redundancy and flexibility, this research evaluates how supermarkets react to unforeseen events.

Methodology

• The context of this study addresses the Canterbury flooding that occurred in May/June 2021 and affected the distribution networks of New Zealand’s South Island (specifically Canterbury, Otago, and Southland).
• A survey was conducted to collect quantitative and qualitative data from supermarkets of the affected areas to understand the strength or fragility of New Zealand’s distribution systems in the aftermath of a natural disaster.
• Data was collected on supplier locations, the level of buffer inventory, replenishment frequencies, and the extent of disruptions on specific categories of goods to evaluate the level of redundancy and flexibility.

Results

• The most common disruptions of the Canterbury flooding were inaccessible roads (77.8%), shortage of goods on shelves (77.8%), longer travel times (66.7%), and cancelled deliveries (72.2%)• 89% replenish stores by using both distribution centres and direct suppliers (implying flexibility)
• 61% can replenish from two distribution centres (implying flexibility).
• 39% believe there is little availability of alternative modes of transport in New Zealand (A lack of flexibility)
• 82% of the respondents have relations with more than two direct suppliers (implying redundancy)
• 61% agreed there is an ample amount of buffer inventory present in New Zealand’s consumer goods system (implying redundancy)

Analysis

New Zealand’s distribution system has shown to have an amount of resilience (redundancy and flexibility) present. However, findings from the survey highlighted the fragility of the network from a lack of alternative modes of transport and road infrastructure to move goods from suppliers to retailers.

Conclusion

Designed By: Dylan Treweek
Supervised By: Cecile L’Hermitte
Acknowledgments: Aidan Hamilton

References: