The Elphinstone Review is the University of Aberdeen's student-led academic journal. Our aim is to publish the very best work produced by undergraduate students at the University, meanwhile providing students with invaluable experience of editing and writing for an academic journal.

Founded in 2015, The Elphinstone Review started as an Arts and Social Sciences journal. Since then, however, we have expanded our scope and are interested in receiving submissions from all subject areas. As a result, the editorial board each year ideally consists of students from all schools and all levels of study.

We hope you will enjoy this year's volume of The Elphinstone Review. Our hope is that you will find yourself inspired by its content and appreciate the outstanding work produced at The University of Aberdeen.

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Editorial

Freya Main, Autumn Antonson, and Veronika Wendler

We are proud to present the eleventh volume of The Elphinstone Review, the University of Aberdeen's academic journal. This year's edition is a pinnacle for us, not only in quality but also in reach. We received a record-breaking 46 submissions, of which thirteen outstanding papers were selected for publication. True to our mission, this volume offers an interdisciplinary snapshot of undergraduate scholarship at its finest, and the selected papers span a diverse array of fields, with particularly strong contributions from medicine, environmental sciences, history, psychology, and law. From explorations of colonial legacies in global health, ethical debates surrounding the legal personhood of artificial intelligence, and even an introduction to the use of cutting-edge tools like the 'Anatomage' virtual dissection table in Aberdeen's medical department, this year's contributions challenge, inform, and inspire!

Bringing this volume to life has been a truly collaborative effort, and we are immensely grateful to everyone who supported us along the way. We extend our heartfelt thanks to Wendy Arthur from the School of Education, whose steady guidance and encouragement has been invaluable throughout the editorial process. We are also thrilled to feature another beautiful cover, designed by Alison Hay.

This year also marks a significant development for the future of The Elphinstone Review. Thanks to the generous multi-year funding provided by *The Development Trust's Student Experience Fund*, we are now able to ensure greater continuity and stability for future editorial teams. This support enables us not only to print and launch each edition with confidence but also to foster an even more interdisciplinary environment for student-led academic publishing at Aberdeen. To those reading who feel inspired, whether as a writer, editor, or creative contributor, we warmly encourage you to get involved. On behalf of the editorial team, thank you for joining us in celebrating the work of our peers. We hope you find this volume as thought-provoking and inspiring as we did.

The opinions expressed in the articles presented hereafter do not necessarily reflect the views of the institution, the editorial board, or the contributors. They should be viewed as exercises of academic criticism intended to spark intellectual debate.

The Postcolonial Condition: Empire, Health, and Enduring Global Inequities

Topaz Manneh [1]

This paper examines the deep-rooted health disparities forged through centuries of colonial influence, revealing how systems of exploitation, racial hierarchy, and cultural erasure have embedded structural violence into the foundations of global health. Drawing on interdisciplinary research and global case studies, the study uncovers how colonial systems such as economic extraction, social marginalisation, and the suppression of Indigenous knowledge have produced patterns of illness and inequity that persist today. It further critiques the role of international health institutions and policies that, despite their development agendas, often reproduce neocolonial dynamics. In response, the study proposes strategies for inclusive reform, grounded in cultural competency, community engagement, and restorative justice, to rectify the injustices embedded in the colonial history of global health.

Introduction

Health disparities are a persistent global challenge deeply rooted in a complex interplay of historical, social, and economic inequalities (Marmot, 2005). A significant yet often overlooked contributor to these inequities is

[1] Currently pursuing an MSc in Pharmacology at the University of Aberdeen, Manneh is undertaking a year in industry at GSK's headquarters in London, working in Global Hepatology Medical Affairs. Their academic interests span population health sciences, social determinants of health, and global health policy, with a broader focus on how science, technology, and structural factors shape health outcomes. They are particularly committed to patient advocacy and the integration of community perspectives into biomedical research.

the enduring legacy of colonialism (Paradies, 2016). Colonial powers imposed external systems, structures, and ideologies that profoundly altered colonised regions' social, economic, and healthcare landscapes (Górka, 2025). This paper critically examines the colonial foundations of health disparities, analysing how historical colonial practices have shaped contemporary health outcomes and perpetuated deep-rooted inequities across diverse global contexts. By exploring the mechanisms through which colonialism has influenced health systems, this review highlights the importance of addressing these historical injustices to achieve equitable health outcomes.

Legacies of Colonialism: Foundations of Inequity

Colonialism profoundly shaped the development of global health systems, embedding lasting inequities (Tilley, 2016). European colonial powers imposed biomedical health frameworks that disregarded, marginalised, and undermined Indigenous healing systems, prioritising settlers and colonial administrators over Indigenous populations (Bruchhausen, 2020). As a result, health infrastructures were underdeveloped, unevenly distributed, and inaccessible to local communities (Coghe, 2020a; Tilley, 2016). In sub-Saharan Africa, colonial policies systematically favoured Europeans, institutionalising disparities that have endured long after decolonisation (ibid). The introduction of Western medical practices displaced traditional health systems and fostered a legacy of medical distrust, contributing to healthcare disengagement among marginalised populations (UIC, n.d.). Pérez-Escamilla (2020) argues that "neocolonialism created a harmful legacy of poor global health outcomes and widespread health system inequities," while Wispelwey (2024) highlights that "settler colonialism has significant health equity implications for Indigenous and settler populations." While Western medical interventions introduced advancements such as vaccines and disease surveillance, these developments often served colonial economic interests rather than prioritising Indigenous welfare (Packard, 2016). The persistence of healthcare inequities in postcolonial states highlights the need for decolonial

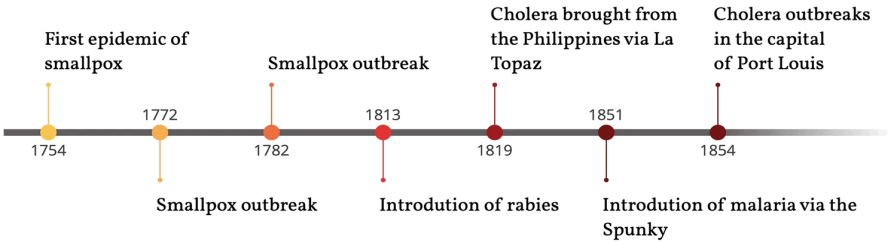
approaches to health policy, ensuring historical injustices are addressed through inclusive and culturally responsive frameworks (Yanful, 2023). Examining the colonial roots of health disparities shows that contemporary health systems cannot be understood without historical context.

Case Studies

Africa

Colonial health policies in Africa were strategically designed to safeguard European settlers from tropical diseases, often at the expense of Indigenous populations (Vaughan, 1991), for example, the epidemics which affected Colonial Mauritius.

Figure 1

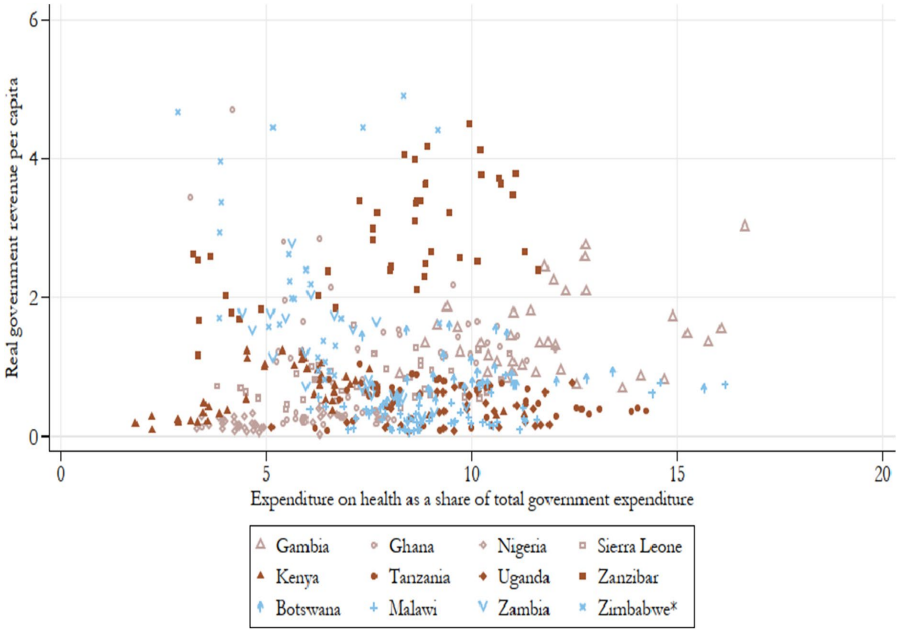


Note. Historical Timeline of Disease Introduction and Epidemics in Colonial Mauritius (Seetah, 2024).

The British colonial administration in Kenya, for example, prioritised controlling malaria and sleeping sickness to protect Europeans, leading to the creation of segregated health facilities that marginalised Indigenous health needs (Coghe, 2020b; Tilley, 2016). This systematic segregation reinforced disparities that persist today as colonial-era infrastructural imbalances continue to shape healthcare accessibility (Beck, 1970).

Figure 2

Note. The figure illustrates the disparity in healthcare spending across



various African colonies, highlighting how similar government revenue per capita levels did not necessarily translate into equitable health spending (Bolt & Cilliers, 2025). This discrepancy reflects the colonial imperative to maintain administrative efficiency and economic productivity rather than addressing broader health needs (Packard, 1989).

While some argue that colonial interventions contributed to disease control and introduced modern medical practices, these benefits were disproportionate, primarily serving European interests (Packard, 2016). The enduring legacy of these policies can be seen in contemporary African healthcare systems, where inequities in resource allocation and healthcare access remain prominent (Tilley, 2011). See Appendix A.

Asia

British colonial rule in India significantly reshaped public health dynamics, often reinforcing systemic inequities even as it introduced medical advancements (Arnold, 1993). Western medical institutions were established, yet services largely remained inaccessible to much of the Indian population (Harrison, 1994). Public health interventions were primarily driven by economic and administrative concerns, focusing on diseases like cholera and plague that threatened colonial stability (Sriram et al., 2021a; IJMRA, 2023). The protection of governance and trade is often justified by selective public health measures (Bhattacharya, 2006). Although British policies supported medical infrastructure and epidemiological surveillance, their narrow focus prioritised elite and urban populations, frequently overlooking rural and marginalised communities (Amrith, 2006). Some argue that colonial institutions laid the groundwork for India's modern healthcare system (Hardiman, 2006). However, this view can understate the exclusionary nature of these policies and their role in sustaining structural inequities. Contemporary health disparities in India, particularly in rural access and public health funding, reflect these historical legacies, highlighting the importance of decolonial approaches to health policy (Sen, 2005).

The Americas

In Latin America, Spanish and Portuguese colonial powers introduced European medical frameworks that often excluded Indigenous populations (Cueto, 2007). In colonial Mexico, health policies prioritised Spanish settlers, while Indigenous communities faced devastating epidemics introduced by European contact (Yero & O'Brien, 2022b). These policies, shaped by a colonial worldview, contributed to demographic collapse and long-lasting health disparities (Cook, 1998). The presumed superiority of European medical practices often justified the displacement of traditional healing systems (Newson, 2013). While European medical institutions sometimes facilitated knowledge exchange and new treatments, they were typically designed to serve colonial elites, reinforcing hierarchies of care

(Arras, 2013). The enduring impact of these policies is visible today as Indigenous populations across Latin America continue to face disproportionate health burdens and limited access to care (Hutchison, 2018). Understanding these historical dynamics is essential for designing inclusive health policies that address these long-standing inequities (Yero & O'Brien, 2022b).

Key Figures and Policies

The discoveries of figures such as Sir Ronald Ross and Carlos Finlay were instrumental in shaping colonial public health policy, though their implementation often reflected structural inequities (Tilley, 2016). Ross's 1897 discovery of mosquito-borne malaria transmission informed anti-malaria campaigns across British territories, including mosquito eradication and environmental modifications (Britannica, 2024). However, these measures primarily aimed to protect European settlers, soldiers, and administrators, often leaving Indigenous populations at the margins (Bump et al., 2022). Similarly, Finlay's identification of mosquitoes as vectors of yellow fever shaped interventions in Spanish colonies, though these efforts were typically designed to safeguard colonial economic interests rather than prioritise local health needs (Pérez-Escamilla, 2020). The broader rationale behind these interventions reflected a desire to maintain economic and administrative stability, sometimes at the expense of addressing the health needs of native populations (Packard, 2016). Although some argue that these scientific discoveries laid the foundation for public health improvements, their selective application reveals the colonial roots of health inequities (Vaughan, 1991). Recognising these patterns is vital for understanding how exclusionary policies persist in global health systems today (Yanful et al., 2023).

Colonial public health policies often reinforced systemic disparities under the appearance of medical advancement (Tilley, 2016). The Native Medical Institution, founded in 1822 in India, was intended to train Indian practitioners in Western medicine, aiming to bridge colonial and Indigenous medical systems (Sriram et al., 2021a). However, the institution was later

dismantled in favour of exclusively European-trained doctors, reflecting a wider devaluation of Indigenous medical knowledge (Wispelwey, 2024). This shift was driven by the belief in Western medicine's superiority, which often justified the sidelining of Indigenous healing systems (Packard, 2016). Similarly, sleeping sickness campaigns in early 20th-century Africa illustrate the coercive nature of colonial health interventions (Vaughan, 1991). Policies involved forced relocations, livestock culling, and experimental treatments, prioritising European health and economic stability over the rights and welfare of African populations (Coghe, 2020b; Bump & Moser, 2022). Although such campaigns contributed to disease control, they also fostered deep medical mistrust, which continues to shape health engagement in many communities today. These long-term consequences highlight the need to critically reassess the enduring influence of colonial health policies on modern global health systems.

Pathways of Inequality: Colonial Mechanisms and Health Disparities

Economic Exploitation

Colonial powers extracted natural and human resources from colonised regions, profoundly impacting community health and well-being (Wispelwey et al., 2023). The pursuit of minerals, rubber, and agricultural products often relied on brutal and unsafe working conditions, where individuals were forced into labour for little or no compensation, resulting in severe physical and psychological harm (ibid). In the Congo Free State, the Belgian-controlled rubber trade exemplified this cruelty. Labourers faced mutilation, abuse, and death if they failed to meet quotas, leading to widespread trauma and health deterioration (Hochschild, 1998). Forced labour also disrupted traditional agriculture, triggering food insecurity and chronic malnutrition, with cascading effects on public health (ibid). Similarly, plantation economies in the Caribbean and Southeast Asia subjected enslaved and native workers to relentless labour, extreme climates, and poor living conditions (Beckford, 1972). These exploitative systems led to high mortality rates, chronic illness, and long-term physical and mental health issues (ibid). Colonial priorities favoured export crops like sugar and

tobacco over local food production, worsening malnutrition and weakening community health resilience (ibid). These economic models entrenched cycles of poverty and ill health that persist in postcolonial societies.

Social Hierarchies

Colonialism reinforced rigid hierarchies that marginalised Indigenous populations and deepened health disparities (Czyzewski, 2011). European settlers were privileged, while native populations were systematically denied education, employment, and healthcare (Go, 2023). In British India, colonial rule manipulated the caste system to maintain control, confining lower-caste groups to hazardous, underpaid work and limiting their healthcare access (Houben, 2024; Sriram et al., 2021b). This institutionalised inequality perpetuated cycles of poverty and poor health (ibid). In apartheid-era South Africa, racial segregation created vast disparities in housing, employment, and medical care. Non-white communities were relegated to overcrowded, under-resourced areas, heightening risks of disease and malnutrition (Coovadia et al., 2009; Sparks, 2020). Even post-apartheid, health inequalities persist due to this embedded social stratification (Coovadia et al., 2009; Górka, 2025). Historical marginalisation continues to shape poorer health outcomes for these populations (Czyzewski, 2011).

Cultural Disruption

Colonialism involved the systematic suppression of Indigenous cultures and the imposition of Western ideologies, including medical practices, which had profound effects on health systems (Yamane & Helm, 2022). Indigenous knowledge and traditional healing methods, developed over centuries, were frequently dismissed by colonial authorities as primitive, unscientific, or superstitious (Thomas, 2022; Melro et al., 2024). This devaluation of Indigenous health practices not only undermined the efficacy of local health systems but also contributed to a loss of cultural

identity and community cohesion (Yamane & Helm, 2022). As a result, Indigenous populations often developed a deep mistrust of Western medical systems, a sentiment that persists in many communities today (Thomas, 2022; Smith & Anderson, 2023).

In Africa, colonial campaigns to control diseases such as sleeping sickness involved coercive and often violent measures (Coghe, 2020c; Gani & Marshall, 2022). Entire villages were forcibly relocated to isolate infected individuals and facilitate public health interventions (ibid). These relocations disrupted established social structures, economic activities, and traditional ways of life, causing psychological distress and long-term physical health consequences (Coghe, 2020a). The trauma associated with such policies deepened mistrust towards colonial health authorities, leading to the underutilisation of Western medical services, a legacy that continues to affect healthcare access and uptake in many post-colonial societies (Smith & Anderson, 2023).

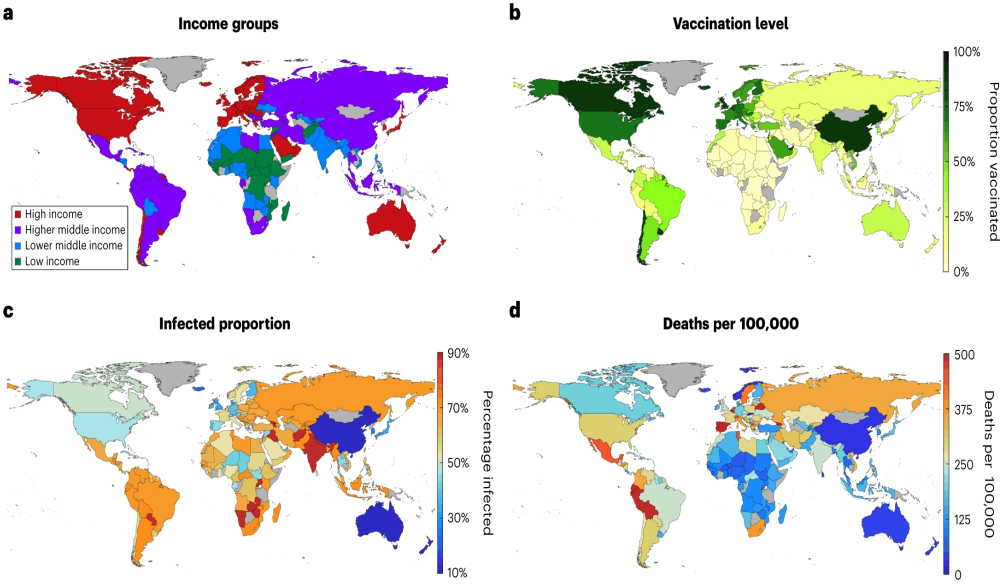
The marginalisation of traditional healers further weakened Indigenous healthcare systems (Atindanbila & Thompson, 2011). In regions such as Latin America and sub-Saharan Africa, traditional healers played a vital role in community health, particularly in rural areas where Western-trained doctors were scarce (Yero & O'Brien, 2022a; Brown & Patel, 2021a). Colonial authorities often discredited and displaced these healers, replacing them with Western-trained medical professionals who were unfamiliar with local customs and needs (Nene, 2014). This shift reduced access to culturally appropriate care, eroded trust in healthcare systems, and contributed to the persistence of health disparities (Yero & O'Brien, 2022a; Brown & Patel, 2021b). The imposition of Western medical practices without regard for Indigenous knowledge systems left a legacy of cultural disruption and weakened the ability of communities to respond effectively to health challenges (Melro et al., 2024).

Persisting Inequities

Colonial legacies continue to shape global health disparities through entrenched structural inequalities (Wylie et al., 2019). These inequities persist in unequal access to healthcare, education, and economic opportunities, especially in formerly colonised regions (Paradies, 2016). Under colonial rule, healthcare infrastructure was designed for European settlers, leaving Indigenous populations underserved—a neglect that endures in underfunded health systems today (Coghe, 2020b; Tilley, 2016; UIC, n.d.). The historical exploitation of resources and extractive economic models imposed during colonisation have left many Global South nations with fragile healthcare systems (ibid).

The COVID-19 pandemic exposed these systemic disparities (Arnold et al., 2022). As Figure 3 illustrates, vaccine distribution favoured wealthier, often former colonial powers, while formerly colonised nations struggled to secure sufficient supplies (Siani, 2024).

Figure 3



Note. Figure shows relative changes in mortality per country under the central vaccine-sharing scenarios.

This inequitable distribution reflects enduring power imbalances and economic disparities rooted in colonial history (Arnold et al., 2022). Wealthier nations had the resources and infrastructure to secure and distribute vaccines promptly, while countries with weaker health systems faced delays, logistical challenges, and reliance on international aid (Khan et al., 2021). This disparity not only hindered these regions' pandemic control but also exacerbated existing health inequities, underscoring the lasting impact of colonialism on global health outcomes (Arnold et al., 2022).

Global Health Governance

Global health organisations, such as the WHO and UN agencies, play a central role in reducing disparities but risk perpetuating neocolonial power dynamics through Western-centric approaches (Sen et al., 2022). These frameworks often misalign with local contexts, undermining the effectiveness of interventions and reinforcing aid dependency (Spanaus & De Souza, 2024). Structural adjustment programmes (SAPs) by the IMF and World Bank in the 1980s–1990s epitomise this tension, as austerity measures demanded cuts to healthcare in many former colonies, weakening systems and deepening inequalities (Thomson et al., 2017; Breman & Shelton, 2006; UIC, n.d.). In response, the decolonisation of global health has emerged, advocating for partnerships that prioritise local knowledge and community-led solutions (Lawrence & Hirsch, 2020; PLOS, 2023a). By shifting decision-making power to marginalised communities, this movement seeks to create culturally relevant, equitable healthcare systems that address enduring colonial injustices (Spanaus & De Souza, 2024; PLOS, 2023b).

Case Studies

South Africa

The enduring legacy of apartheid, a system of institutionalised racial segregation and discrimination, continues to profoundly influence health outcomes in South Africa (Coovadia, 2009). Under apartheid, Black South

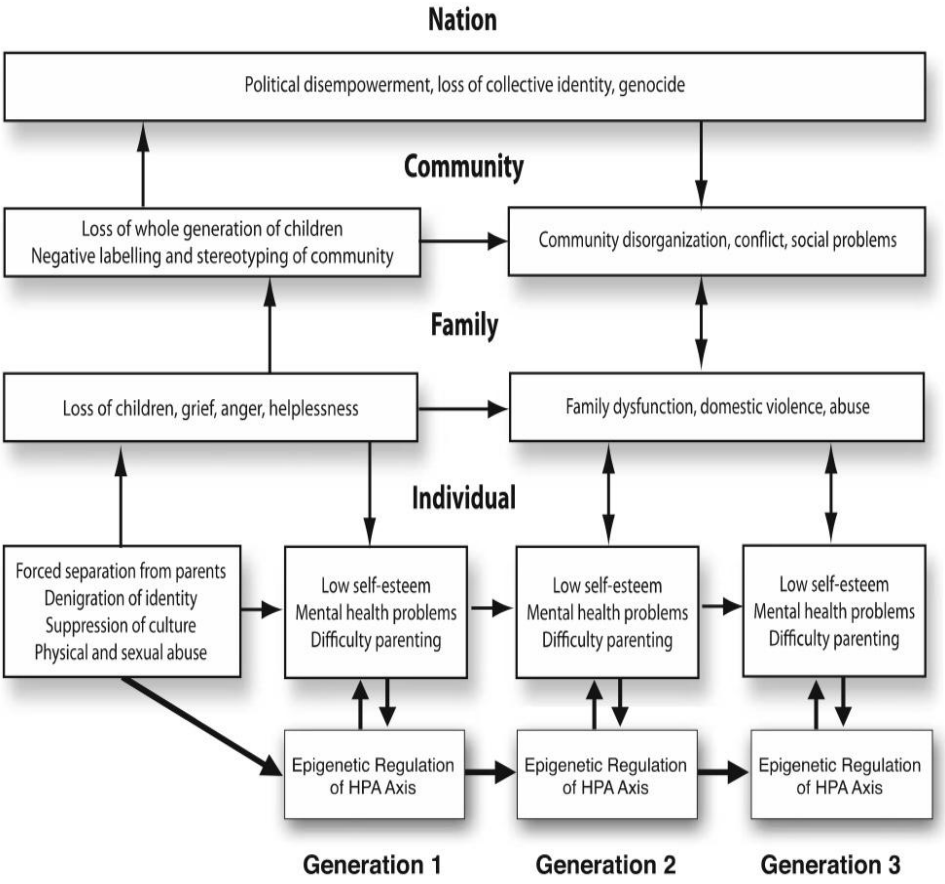
Africans were systematically marginalised and denied access to quality healthcare, education, and employment opportunities (ibid; Gilson & McIntyre, 2001). The healthcare system was designed to favour white populations, while Black communities were left with under-resourced and poorly maintained facilities (Nordling, 2022). Despite the end of apartheid in 1994, these historical injustices have left a pervasive imprint (ibid). Today, Black South Africans experience higher rates of poverty, unemployment, and chronic illnesses compared to their white counterparts (de Villiers, 2021). Disparities in healthcare access, life expectancy, and health outcomes persist, reflecting the deep-seated social and economic inequalities rooted in the colonial and apartheid eras (Coovadia et al., 2009; Nordling, 2022).

India

The caste system, which was reinforced and manipulated during British colonial rule, continues to exacerbate health disparities in contemporary India (Sriram, 2021a). The British administration exploited and codified caste divisions to maintain social control, deepening inequalities that persist today (Sriram et al., 2021b; Patel, 2023). Lower caste communities, particularly Dalits, face systemic discrimination that limits their access to healthcare, education, and employment opportunities (Sriram, 2021b). These communities often reside in impoverished areas with poor sanitation, unsafe drinking water, and inadequate healthcare infrastructure. Consequently, they experience higher rates of infectious diseases, malnutrition, and maternal and infant mortality (Sriram et al., 2021b; Kahambing, 2024). The legacy of colonial policies continues to influence social hierarchies and health outcomes, perpetuating cycles of disadvantage and poor health (Patel, 2023).

Figure 4

The Transgenerational Transmission of Historical Trauma (Paradies, 2016)



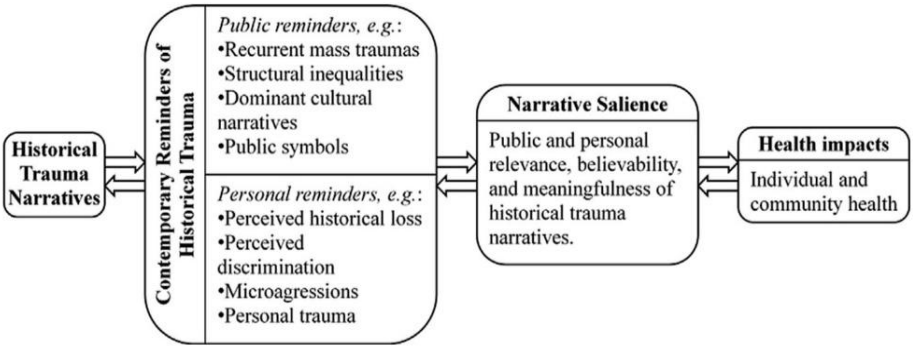
Canada

The health disparities faced by Indigenous populations in Canada are a direct consequence of colonial policies aimed at forced assimilation and cultural erasure (Axelsson et al., 2016a). The establishment of residential schools, which operated from the late 19th century to the 20th century, forcibly removed Indigenous children from their families and subjected them to physical, emotional, and cultural abuse (ibid; Wilk et al., 2017). These traumatic experiences led to intergenerational trauma, loss of cultural identity, and a deep mistrust of government institutions, including healthcare systems. Contemporary Indigenous communities continue to suffer from higher rates of chronic diseases, mental health issues, substance abuse, and

lower life expectancy compared to non-Indigenous populations (Axelsson et al., 2016b; Rink et al., 2024). Limited access to healthcare services, inadequate housing, and socio-economic marginalisation further exacerbate these disparities. Addressing these issues requires acknowledging historical injustices and supporting culturally appropriate, community-driven healthcare initiatives (Wilk et al., 2017).

Figure 5

Narrative Model of Historical Trauma and Health (Paradies, 2016)



Strategies for Inclusive Health Reform

Mitigating colonialism's health impact demands targeted policies that address systemic inequities and foster inclusivity (Jack, 2021). A key step is equitable healthcare funding: governments must prioritise investment in infrastructure, medical facilities, and professional training for historically marginalised regions (Shift Health Accelerator, 2020; American Medical Association, 2024; Gilson & McIntyre, 2001). Redirecting resources to underserved areas can help correct the imbalances rooted in colonial-era healthcare systems.

Inclusive policy design is equally vital. Actively involving marginalised communities ensures that health interventions are culturally appropriate and context-specific (Ortiz-Prado et al., 2021; Patel, 2023).

Community participation fosters trust, credibility, and more effective strategies (NHS England, 2023).

Cultural competency training for healthcare providers is another crucial reform. It equips professionals to understand patients' values and practices, improving relationships and health outcomes (Cigna Healthcare, 2020; Health Policy Watch, 2023b; Betancourt et al., 2003). Such training reduces miscommunication and helps counter the mistrust that often deters marginalised groups from seeking care (Jongen et al., 2018).

Restorative justice measures can also help address historical harms. These include financial compensation, mental health support, and community development initiatives (Alberti et al., 2018; Harvard, 2022). Canada's $350 million healing fund for residential school survivors, for example, is one step toward redressing the trauma caused by forced assimilation policies (Axelsson et al., 2016b; Wilk et al., 2017).

Finally, community-based approaches ensure that health programmes remain sustainable and responsive (Gov UK, 2018; Minkler & Wallerstein, 2008). Partnering with local organisations and integrating traditional healing practices alongside modern medicine enhances relevance, accessibility, and trust in healthcare systems (Health Policy Watch, 2023a; Khatri et al., 2024; Gao et al., 2025).

Research Priorities

Further research is imperative to elucidate the lasting impact of colonialism, inform evidence-based policy solutions and address health disparities effectively (Ramkumar et al., 2025). Longitudinal studies are indispensable for tracking health outcomes over extended periods and identifying trends related to historical injustices (Frontiers, 2023; Marmot, 2020). These studies provide invaluable data on how colonial legacies continue to influence health and can inform policy developments to mitigate these effects (Östlin et al., 2011).

Enhancing data disaggregation is critical for capturing detailed information on health disparities across different demographic groups (Kauh et al., 2021). Collecting and analysing data by factors such as race, ethnicity, socioeconomic status, and geographic location can reveal specific health challenges faced by marginalised communities (Begay et al., 2024; Braveman et al., 2021). Disaggregated data enables policymakers and researchers to design targeted interventions and monitor progress toward health equity (WHO, 2023).

Encouraging interdisciplinary research is another important step. Integrating insights from public health, sociology, anthropology, history, and other fields provides a more comprehensive understanding of the multifaceted factors driving health disparities (Springer, 2016; Krieger, 2021). This holistic approach facilitates the development of nuanced and context-specific solutions that address both structural and cultural determinants of health (Aranda & Wallace, 2022).

Examining the impact of global health policies on marginalised communities is crucial to ensure that international interventions do not inadvertently perpetuate existing inequalities (ibid). Research that evaluates the outcomes of policies implemented by organisations such as the WHO, IMF, and World Bank can highlight areas for improvement and inform more equitable practices (Begay et al., 2024; Labonté & Schrecker, 2007). This research can also identify best practices for decolonising global health governance.

Finally, advancing community-based participatory research (CBPR) ensures that research efforts align with the needs and priorities of the communities being studied (Duke, 2020). CBPR involves community members as active participants in the research process, fostering trust and ensuring that findings are relevant and beneficial (Wispelwey et al., 2023; Wallerstein et al., 2015). This approach democratises research and empowers communities to play a central role in shaping health interventions that affect their lives (Duke, 2020).

Conclusion

Colonialism's legacy is not confined to the past but continues to cast a long shadow over contemporary health disparities across the globe. The systematic exploitation of Indigenous populations through forced labour, economic extraction, and the prioritisation of colonial profit over human well-being (Wispelwey et al., 2023; Hochschild, 1998; Beckford, 1972) established enduring cycles of poverty, food insecurity, and chronic disease. At the same time, rigid social hierarchies entrenched by colonial administrations, such as those in British India and apartheid South Africa, institutionalised unequal access to healthcare, education, and employment. This disproportionately burdened marginalised communities with preventable illness and early mortality (Czyzewski, 2011; Go, 2023; Coovadia et al., 2009).

Beyond physical structures and economic systems, colonialism also inflicted deep cultural wounds. The suppression and devaluation of Indigenous medical knowledge systems weakened community resilience and sowed mistrust in healthcare institutions. This sentiment persists today and continues to influence health-seeking behaviours (Yamane & Helm, 2022; Smith & Anderson, 2023). Violent public health campaigns, forced relocations, and the marginalisation of traditional healers disrupted social cohesion, diminishing the ability of colonised communities to maintain culturally safe and accessible health practices (Coghe, 2020c; Atindanbila & Thompson, 2011; Brown & Patel, 2021a).

This colonial inheritance has shaped the modern global health landscape. From the structurally underfunded health systems of many postcolonial states (UIC, n.d.) to the vaccine apartheid exposed during the COVID-19 pandemic (Arnold et al., 2022; Siani, 2024), health inequities are continually reinforced by power imbalances rooted in a colonial past. Even international health governance, often guided by high-income nations and global institutions like the WHO, risks reproducing neocolonial dynamics by prioritising Western values and agendas over local autonomy and culturally appropriate solutions (Sen et al., 2022).

The disparities we see today are not due to broken systems but rather systems functioning as they were initially designed to benefit some while disadvantaging others. These issues are not just historical; they are ongoing realities. To address health inequity effectively, we need to recognise it as a direct consequence of colonialism. This requires more than minor policy changes or symbolic actions. It calls for a fundamental rethinking of health that prioritises justice, equity, and the experiences of those who have been historically marginalised. Decolonising health involves unlearning harmful practices, restoring cultural knowledge, and redistributing power.

Ultimately, recognising the historical foundations of modern health disparities is essential for dismantling the colonial structures that persist in global health systems. Genuine efforts toward health equity must address not only present-day economic and social inequalities but also the historical injustices that created them. This means supporting decolonial approaches to healthcare, amplifying Indigenous knowledge systems, and ensuring equitable global partnerships that empower rather than exploit. To dismantle the structural violence embedded in these entrenched systems, we must confront uncomfortable truths: today's health inequities are not accidental but inherited. Decolonising health is not symbolic; it is a moral imperative.

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Anatomage: Will Virtual Dissection Ever Replace the Real Thing?

Tessa Yau and Orla Vennard [1]

Cadaveric dissection has traditionally played a central role in anatomy teaching within the medical curriculum. Whilst modern teaching using bequeathed cadavers remains gold standard, cadaveric availability has declined in recent years. With rising student numbers and the COVID-19 pandemic further limiting cadaveric exposure, there has been a global shift towards virtual teaching strategies. The Anatomage ® virtual dissection table simulates aspects of the learning experience using digitalised cadavers, showing great promise as a tool for both medical education and in clinical settings. Following recent acquisition of the Anatomage table by the University of Aberdeen, new research initiatives are underway to evaluate the effectiveness of the table and assist with its integration into the current curriculum. This article reviews the history of anatomy teaching, examines the evolving role of cadaveric specimens, and discusses strengths, limitations and future directions for digital anatomy education.

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Introduction

Human anatomy studies the internal and external structures within the body and how they are physically related (Blanchard, 2005), forming a key cornerstone of medical science courses (McLachlan & Patten, 2006). Having a comprehensive understanding of anatomy is important in clinical settings for accurate diagnosis and treatment of disease (Turney, 2007). Traditionally, anatomy is taught through cadaveric dissection and didactic lectures, in conjunction with textbooks and other written materials. However, the use of cadaveric dissection has recently declined in popularity, with some medical schools no longer including this in their curriculum (Munro, 2023). The COVID-19 pandemic brought a drastic change in conventional anatomy teaching methods, accelerating the rise in demand for technological resources to supplement in-person teaching. One such resource which has risen in popularity is a digital healthcare platform, Anatomage Inc. Founded in 2004 by Dr Jack Choi in California, Anatomage specialises in creating digitalised versions of real human bodies. One of their products, the Anatomage table, presents a life-sized digital depiction of the human body using data from real cadavers (3D Anatomy Visualization and Simulation System, n.d.). This allows students to go through different layers of the body and understand the relationships between structures. Whilst research into the effectiveness of the Anatomage table is still in its infancy, the results so far have been promising. The University of Aberdeen's anatomy department has recently acquired an Anatomage table, which is being incorporated as an adjunct to current teaching methods in the medical sciences curriculum.

This article aims to:

1. Explore how Anatomy teaching has evolved over the years.

2. Explain the origins and current uses of Anatomage, looking into current research into its efficacy particularly in medical education.

3. Discuss local research initiatives into Anatomage at the University of Aberdeen.

The History of Anatomy Teaching

Dissection has always formed a vital part in the study of anatomy. The term anatomy is derived from the Greek word “anatome”, meaning to cut open or dissect. The first documented scientific dissection on a human cadaver date back to the third century B.C. By the 16th century, anatomy was established as an academic discipline and became a mandatory aspect of the medical curriculum. Shortly after, dissections on human cadavers were introduced as a method of teaching anatomy by John Caius at Cambridge University in 1557 (Ellis, 1993).

Aberdeen University began teaching anatomy in 1636, just over a century after the university was founded. Anatomists, such as Professor William Godon and Dr Charles Skene, continued to advance the anatomical curriculum at Aberdeen, with cadaveric teaching - whether on animal or human cadavers - as a cornerstone of the curriculum (Humphries, 2014).

Figure 1

Portrait of “The Anatomy Lesson of Dr. Nicolas Tulp”

Note. "The Anatomy Lesson of Dr. Nicolaes Tulp", painted by Rembrandt in 1632 (BBC Bitesize, 2022).

The Current Anatomy Curriculum

Cadavers continue to form a large proportion of anatomy education, being used in a variety of ways. Teaching using dissection involves students cutting and separating layers of tissue, to expose certain anatomical structures. In comparison, prosection uses cadavers previously dissected by experts, as teaching examples for students. Plastic models can be used as an alternative visual aid, and may offer a clearer depiction of structures, where certain elements can be highlighted.

At Aberdeen University, anatomy is part of the curriculum for biomedical science, medical and dentistry students. Currently, most anatomy teaching at Aberdeen is prosection based. Students undertake regular lab sessions, where they go through a variety of prosections based on the subject being taught. Biomedical science students have the additional opportunity to participate in cadaveric dissection. Most of the core anatomy content is taught through self-guided workbooks, with the addition of lectures and online resources. They offer the opportunity for group work and consolidation of learning outside of the classroom, so students are not reliant on timetabled slots in the anatomy lab.

Benefits and Challenges of Cadaveric Teaching

There are many reasons why cadaveric teaching is considered the gold standard method (Pasricha et al., 2023). The humanistic aspect of cadaveric teaching helps students develop a patient centred perspective (Dissabandara et al., 2015). To honour the generosity of body donors, a memorial service is held for students, staff, and the donors' families, providing an opportunity for all to show their respect. For many students, this may be the first time they are exposed to death, offering valuable experience that can help prepare them for future encounters in their

professional careers. Moreover, this experience hones soft skills, such as empathy, compassion and respect, which are beneficial for developing professionalism in clinicians. Additionally, the realistic anatomical variations represented by cadavers help to improve student's understanding of anatomical structures and their physiological role in health and disease (Pasricha et al., 2023). Cadaveric dissection has additional benefits, such as improving manual dexterity skills. This proves the central role cadavers play in anatomy teaching, providing students invaluable skills that are hard to obtain through other teaching methods.

The positive sentiment towards cadaveric teaching is not felt by all students. Many students feel fear and anxiety approaching cadaveric dissection, which can negatively impact the learning environment (Romo-Barrientos et al., 2020). This can be impacted by cultural and religious concerns, as well as the surroundings themselves - for example, the smell and unfamiliarity of cadavers. These concerns can prevent students from gaining a comprehensive understanding of anatomy. Wisenden et al. (2018) found that the anxiety surrounding cadaveric dissection can be deemed as an obstacle to learning, distracting students from staying focussed on the anatomy teaching.

Ethical and Social Implications Associated with Sourcing Cadavers

The sourcing of cadavers has raised numerous ethical concerns. Historically, any unnatural alteration of the human body was considered unsacred and criminal. An Alexandrian physician, Herophilus, challenged such social principles with the need for scientific exploration. He undertook several hundred dissections on living prisoners, known as vivisections, justifying its purpose for the rest of society. Vivisection was utilised for several decades before it was banned after being considered inhumane and against religious practices. It was not until the 14th Century dissection was reintroduced by Mondino de Luizzi who undertook the first public dissection of prisoners (Comer, 2022). During the 1820s', renowned Edinburgh body snatchers, Burke and Hare, succumbed to sourcing bodies from graves when there was a shortage of cadavers for teaching in Dr Robert Knox anatomy

school (Mitchell et al., 2011). Aberdeen also partook in this practice, with tales of students taking the journey by boat to Peterculter to source bodies from graves. Andrew Moir - a renowned anatomy lecturer in Aberdeen - founded his own anatomy teaching theatre. Not long after, the remains of bodies were discovered in the grounds of his theatre, resulting in great public unrest. A year later, the 1832 Anatomy Act was introduced which legalised the use of unclaimed bodies for dissection, introducing tighter regulations on the license to practise dissection (Humphries, 2014).

Figure 2

An 1888 Engraving of Body Snatchers (or Resurrectionists) in Action

Note. This figure shows a gang of body snatchers (also known as resurrectionists) digging bodies from graves to sell onto medical schools and private doctors. (BBC Bitesize, 2022)

The importance of consent for body donors has been recognised since the 1960s. In 2012, the International Federation of Associations of anatomists published guidance, to minimise the unethical sourcing of cadavers, such as the use of unidentified bodies or deceased criminals (Recommendations for Good Practice around Human Tissue Image Acquisition and Use in Anatomy Education and Research - IFAA,. n.d.). However, globally this is not enforced. Habicht et al., (2018) found a quarter of countries studied still rely on unclaimed bodies as their main source of cadavers, whilst other countries, such as Libya, rely on cadavers imported from abroad. This drives continual ethical concerns behind the sourcing and maintenance of body donations.

The impact of the Cadaveric Shortage on Medical Education and Training

Other obstacles to cadaveric teaching remain, such as supply and demand issues. With growing pressure from the Scottish government, medical student numbers are rising exponentially. Despite Scottish medical schools increasing student intake by 274 students between 2022 and 2023, cadaver numbers increased by only 9 (Corpse Shortage due to Rise in Scottish Medical Students - Report, 2024). With Government plans to double UK medical school intake by 2031, there is advancing concern over the shortage of body donors (Expansion of Medical School Places to Be Accelerated to next Year, 2023). This has already had downstream effects on students and other clinical training programmes.

As universities become dependent on limited cadaver numbers, the student to cadaver ratio has increased, negatively impacting the overall

quality of teaching. At least 2 UK universities have stopped using cadavers in their curriculum altogether, with some universities, such as Sheffield, permanently closing their body donation systems post COVID-19 (Munro, 2023). Reducing or removing cadaveric dissection altogether during the pandemic resulted in a notable deficiency of clinical procedural skills in medical graduates (Memon, 2018). Furthermore, when the practical aspects of anatomy teaching are compromised, students will likely show reduced interest in a surgical career. Jacques (2024) has highlighted the significantly reduced number of English surgical applicants in the past decade. An effective undergraduate anatomy curriculum is key to enthusing undergraduate students into the surgical pathway. As our workforce of doctors evolve, it is vital to maximise potential surgical graduates, by maintaining an effective and inspiring undergraduate anatomy curriculum. For existing surgical trainees and consultants, cadaveric materials are often utilised in training programmes to maintain and advance their skill set (Gilbody et al., 2011). Surgical training courses have had to be cancelled to prioritise medial schools' cadaveric demand (Smith & Mathias, 2009). With no alternative source of cadavers outside of cadaveric donation schemes, virtual cadavers could play a role in alleviating the strain on resources.

Because cadavers are sourced from the public as part of a voluntary donation scheme, the cadaveric population is not always representative. In 2017, 100% of donated cadavers in Johannesburg were white individuals (Brits et al., 2020). Most anatomy resources, including both cadaveric teaching and anatomy textbooks, are based on white males, creating a healthcare system designed to best fit this demographic (Dluzen et al., 1996). This can have long lasting consequences for both healthcare professionals and patients, with the potential to further drive healthcare inequalities.

A Shift Towards Virtual Teaching Methods

The anatomy curriculum is constantly evolving, with attempts to address issues surrounding traditional teaching methods. The General Medical Council’s (GMCs) medical director states: “With up-to-date information at our fingertips via trusted sources on our smartphones we don’t

need the huge repository in our heads from textbooks and lectures" (Jacques, 2024). As technology advances, the vast field of anatomical knowledge can be accessed from our home. The GMC recognises the value of problem solving and self-directed learning, moving away from more traditional didactic teaching. With the rise of platforms such as Anatomage, there is potential for universities to integrate virtual teaching methods into their curriculum. This can equip students with a greater depth of anatomical understanding, helping to bridge the gap between scientific learning and clinical application.

Advances into virtual teaching have accelerated due to the COVID-19 pandemic, where almost all in person teaching was halted, meaning universities had to rely on alternative methods. Universities across the globe rapidly adapted their curriculums, with the aim to minimise disruption to student learning. However, this fast transition in teaching methods came with a new set of challenges. With a curriculum based solely on virtual teaching, gaps in students' learning became evident (Smith & Mathias, 2010). Sin et al. (2022) highlights that more than 75% of students felt anatomy teaching during the pandemic had negative impacts on the quality of their education, due to the reduction in interactive learning.

As medical students who started our course during the height of the pandemic, we experienced many challenges when studying anatomy. We were largely taught using online lectures and resources, with minimal physical interaction with cadavers. To substitute for our lack of exposure to cadaveric specimens, we had virtual lab sessions where tutors would live stream tutorials featuring cadaveric prosections. Whilst these tutorials were useful and gave us the best exposure possible for the specimens, it was difficult to get an appreciation of the structures in 3D, which plays a key part in developing a deeper understanding of anatomy. In addition, technical issues were a source of frustration, with lag and camera quality affecting our ability to clearly visualise structures that were being highlighted by the tutor. Overall, our cohort found anatomy difficult to learn and unengaging. This negative sentiment has been echoed across the globe - a survey of 300 Pakistan medical and dental students found over 80% of students longed for traditional anatomy learning and 66% noted a lack of self-motivation. Only

8% of students were fully satisfied with virtual classes (Salman et al., 2022). Despite the challenges faced during the pandemic, virtual teaching did offer benefits, including greater accessibility and time flexibility. The pandemic has influenced a shift in medical education where universities have begun to integrate the benefits of face-to-face and virtual methods, creating a new blended curriculum.

Enhancing Medical Education with Anatomage

Anatomage digitalises human bodies using frozen cadaver slices which have been segmented from real bodies donated for research. These slices are reconstructed to recreate the cadaver's pre-mortem form in a 3D digital format. An ever-expanding portfolio of different bodies have been accumulated to include male, female, geriatric and pregnant models. This helps to overcome the shortage of diverse cadaveric specimens, as once the cadaver has been digitalised it has unlimited uses.

Many features of the Anatomage table are beneficial to anatomy teaching. Layers of the body can be removed in a stepwise process to simulate the dissection experience. Structures can be virtually manipulated, allowing students to appreciate spatial relationships. The newer functional anatomy feature displays the behaviours of real tissues during physiological processes. For example, a cardiac motion tool allows simulated cardiac movements to be visualised. Tutors can create quizzes and short learning exercises called 'presets', for students to work through using a self-directed team-based approach (3D Anatomy & Virtual Dissection Platform, n.d.). The opportunity to facilitate small group learning for anatomy helps encourage active learning and peer teaching. Effective teamwork is vital for medical professionals, who need to effectively communicate as part of a multidisciplinary team, hence it is valued by healthcare regulators such as the GMC (General Medical Council, 2024).

With the ethical concerns and current shortage in cadavers, Anatomage is hailed to be a suitable virtual substitute. In the long run, Anatomage may prove to be economically advantageous. There would be

lower lab maintenance fees and a decreased demand for experienced lab technicians, of which there is already a shortage of (McCuskey et al., 2005). Compared to real life dissection, students undertaking virtual dissection can undo any mistakes they make during the dissection process. Hence, Anatomage may help minimise anxieties students face surrounding dissection, giving them the confidence to fully engage with the task without risking permanent damage to the cadaver. Traditional dissection comes with various risks such as exposure to sharps and inhalation of embalming chemicals such as formaldehyde, the latter of which is not only unpleasant but can also cause airway irritation (Elshaer & Mahmoud, 2017). Hence, we can argue that Anatomage appears to be a worthy long-term investment which brings the benefits of cadaveric dissection whilst avoiding many of the negative implications associated with it.

Current research into Anatomage has found promising results, with most studies concluding it is useful as an additional learning adjunct alongside cadavers and existing teaching methods. Objectively, studies have shown that students who used Anatomage have improved test scores compared to students using other conventional learning modalities (Afsharpour, 2018; da Silveira, 2022). Questionnaires assessing student perceptions on Anatomage have yielded positive responses, with one study showing that many students preferred using Anatomage as an additional tool to cadaveric dissection, compared to dissection alone. 89% of this cohort believed Anatomage helped them to better understand anatomical relationships and improved their ability to visualise the body system (Alasmari, 2021). Additionally, 78% of students said Anatomage made learning more engaging, with 63% of students agreeing that Anatomage improved their understanding of 3D anatomy (Brown et al., 2015).

An important caveat to this is in most current literature, Anatomage has been deemed an appropriate adjunct to traditional dissection rather than a complete replacement. In one survey, 87.9% of participants discouraged virtual anatomy dissection completely replacing traditional human body dissection (Koney, 2024). There may be many reasons for this. Research into Anatomage faces several limitations, such as small sample sizes and selection bias, where sign-ups to use Anatomage and participate in studies

have been on a voluntary basis. In addition, a lot of the studies only focused on one anatomical region, failing to acknowledge the spectrum of difficulty associated with learning about different anatomical regions. For example, head and neck anatomy is one of the most challenging topics for students to learn (Hall et al., 2018), which presents an opportunity for Anatomage to help address this challenge. However, the potential contribution of the Anatomage table based on what subject is being taught is yet to be explored. Satish et al. (2023) also highlights certain technical challenges of the Anatomage table, such as the system being laggy and unresponsive at times. This can make using the table frustrating and difficult to navigate, which has negative consequences on the quality of teaching and the overall learning experience. It is important for future research to address these limitations, to help optimise the use of Anatomage as a teaching tool

Potential Applications for Anatomage in a Clinical Setting

Anatomage as a training tool is not only limited to undergraduate students, it is also useful for qualified clinicians to learn and maintain skills. Medical and surgical trainees can use Anatomage bodies to practice surgical skills and clinical procedures prior to doing this on a real patient. A cross-sectional survey on plastic surgery residents suggested that Anatomage helped to save time in theoretical learning and in surgical procedures. It presents as a viable alternative to be incorporated into their training programme, with its role being of particular importance during the pandemic (Zingaretti et al., 2020).

Current studies show promising results surrounding the use of Anatomage in clinical settings. For example, Anatomage can be integrated with real patient medical imaging data such as CT and MRI scans to assist with detailed radiological interpretation. In one study, the Anatomage table was used to create anatomical dissection images of orbital floor fractures to help with the assessment of surgical management using titanium mesh. Surgeons reported that in comparison to the CT scans, images created from Anatomage were of higher clarity in both preoperative and postoperative images (Brucoli et al., 2018). It can be a useful tool to show patients their

own pathology in a more digestible way compared to 2D black and white images, helping enhance patient understanding of their condition, thereby increasing confidence and improving patient safety (Commission on the Future of Surgery, n.d.). With many more possibilities that are yet to be explored, Anatomage technology may become an integral part of clinical practice in the future.

Anatomage in Action: Use at the University of Aberdeen

Figure 3

Anatomage in Action

Note. This figure depicts second year medical students at the University of Aberdeen being taught anatomy using the Anatomage table. Photo courtesy of the University of Aberdeen Anatomy department.

In April 2024, the University of Aberdeen's anatomy department acquired an Anatomage table to serve as an adjunct to current teaching methods. To date, it has been utilised for teaching Year 1 to Year 3 medical students through the creation of presets which would be tailored to the learning outcomes for each module. A recent online poll aimed at year 2 medical students, carried out by Aberdeen University Anatomy Department [Unpublished], showed that 86% of students agreed Anatomage helped to improve their understanding to varying degrees. Free text comments in this survey corroborated the point that one of the perceived benefits of Anatomage is the opportunity for teamwork with fellow students. However, the opinion in some literature of Anatomage being a difficult interface to navigate without the appropriate training was echoed in Aberdeen students.

One of our upcoming projects this year is to explore the virtual dissection tool, which has not yet been utilised by the department in teaching. Whilst current literature explores the benefits of virtual dissection as a tool to aid teaching and learning, with the intention of improving recall and understanding of anatomy, the benefits of this as an activity prior to real dissection is yet to be studied. We hypothesise that by using Anatomage, students will be able to gain confidence and familiarity with the multiple stages of dissection and be more familiar with the spatial relations of anatomical structures, prior to completing dissection on a cadaver. This helps to decrease student reliance on staff during dissection and reduces the risk of unintentional and irreversible damage to cadaveric structures. Subsequently, higher quality dissections are achieved.

In our project, we aim to create a series of presets using Anatomage to be completed by Year 3 Anatomy students prior to cadaveric dissection. These presets will aim to improve spatial awareness of the anatomical structures that they will be dissecting. Questionnaires will be distributed to

students after this exercise to evaluate the effectiveness of Anatomage as a tool to improve cadaveric dissection skills. Following this, data looking at students' perception of Anatomage as a teaching tool prior to dissection class will be evaluated. Student feedback will help the department to determine whether the table is a valuable tool to be implemented prior to dissection, and if so, will help facilitate integration of table within the course curriculum. Optimal group size, preset types and timing of table use in relation to their cadaveric dissection, can be determined. Beyond this research project, the use of Anatomage, if implemented alongside dissection, should be regularly evaluated, in line with student opinion, to ensure the continued advancement of the anatomy curriculum.

Conclusion

Anatomy education is a constantly evolving landscape. Whilst in the past, teaching using cadaveric specimens was the mainstay technique, in recent years there has been a decline in popularity and a shift to alternative methods, particularly in the virtual space. Virtual platforms, such as Anatomage, enhance the clinical application of anatomical teaching, providing numerous benefits over traditional cadaveric dissection. These include a greater cadaveric diversity, reduced resource strain and reduced ethical concerns. Current studies on Anatomage have garnered positive responses from students as a tool to deepen anatomical understanding, potentially improving exam performance. However, obstacles such as technological complexities and a lack of life-like anatomy have been highlighted. As a result, studies suggest that Anatomage is best used as an adjunct to traditional dissection rather than a complete replacement. Further studies are required to evaluate the benefits of Anatomage and define its exact role in the anatomy curriculum.

Despite the continual evolution of anatomy teaching, traditional cadaveric dissection has stood the test of time as a successful teaching method. It is unlikely that it will disappear entirely. However, as we follow the trend towards more virtual teaching strategies, we will see Anatomage rise in popularity and become a staple in the anatomy curriculum. Reflecting

on our own experience of being taught anatomy during the pandemic, we strongly believe Anatomage would have had the potential to enhance our learning experience in areas where other forms of virtual teaching fall short. We are hopeful that our current research initiative will contribute to the successful integration of Anatomage into the Aberdeen curriculum and help future cohorts with learning anatomy in the most efficient and effective way.

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Resituating the University of St Andrews in the Scottish Enlightenment Philosophical Tradition

Gordon Robertson[1]

Much has been written in the literature about the role Scotland's ancient universities in Edinburgh, Glasgow, and Aberdeen played in cultivating the Scottish Enlightenment. Mainstream historiography has neglected the University of St Andrews, frequently dismissing it as too small, impoverished, and peripheral to have played a significant role. Overcoming unfavourable circumstances at the beginning of the 18th century, St Andrews came to embrace Enlightenment thought and pedagogy through its microcosm of philosophes. Foremost among these literati was Robert Watson, Professor of Logic, Rhetoric and Metaphysics. Unlike his more familiar contemporaries in the pantheon of the Scottish Enlightenment, Watson published no philosophical work. Nevertheless, archival research into the notes taken by his students provides considerable insight into his intellectual activity. Watson emerges as a quintessential man of letters who moved in the same circles as Kames, Smith and Blair, and instilled within his students the aesthetic appreciation of refined taste and belles-lettres required to navigate polite society.

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Introduction

Eighteenth-century Scotland was the wellspring of an unprecedented intellectual and cultural transformation that came to be known as the Scottish Enlightenment. From inauspicious beginnings, an extraordinary movement of independent thinking and tolerance for conflicting philosophical ideas emerged, extending into other fields as diverse as economics, sociology, literature, jurisprudence, and science. It might be expected that St Andrews, as Scotland's oldest university (founded in 1413), would have been instrumental in the Scottish Enlightenment. This, however, belies the significant, though not insurmountable, impediments confronting St Andrews in the 18th century. Professorial structure, religiopolitical affiliation and geographical location all dictated the speed and extent to which St Andrews could engage with Enlightenment thinking. Furthermore, a skewed historiography has tended to lionise the work of certain luminaries of the Enlightenment at the expense of less prominent, though still very significant, figures. Thus, St Andrews is often overlooked or relegated to a footnote in mainstream accounts of the Scottish Enlightenment, a scholarly neglect that has long deserved appropriately balanced redress. As this case study illustrates, shedding new light on surviving primary source records enables us to uncover the characteristic hallmarks of Enlightenment thought within the University of St Andrews.

Historical Context

The existence of five ancient universities in Scotland at the turn of the 18th century was a remarkable achievement for a small, impoverished country still reeling from the disastrous Darien scheme and the "Seven Ill Years" of famine in the 1690s. It indeed compared favourably with its southerly neighbour, which at that time possessed only the universities of Oxford and Cambridge. Scottish universities were cautiously emerging from a previous century of religious turmoil, civil war, and constitutional change. The ideological culling of university professoriates who were not conspicuously loyal to the Protestant monarchy from the reign of William III onwards was widespread. This proved particularly draconian at St Andrews,

where the Glorious Revolution of 1688 resulted in the abolition of the Episcopalian archbishopric, precipitating a collapse in its status as an important ecclesiastical centre (Reid, 2011: 96). In contrast to the Universities of Glasgow and Edinburgh, St Andrews (alongside Aberdeen) retained a lingering reputation for Episcopalianism and Roman Catholicism, which fomented support for Jacobitism. The suspicion this elicited from the Whig polity and Kirk triggered an inquisitorial Visitation Commission of 1690 that investigated the religiopolitical allegiances and pedagogical practices of the St Andrews regents, most of whom were summarily replaced by "men with more acceptable political and religious views" (ibid.: 97). The consequences for non-conformance to Presbyterian orthodoxy were not to be underestimated, as exemplified by the public execution for blasphemy of the Edinburgh undergraduate Thomas Aikenhead in 1697. Among Aikenhead's offences was openly dismissing Christian theology as "a rapsidie of faigned and ill-invented nonsense" (Hunter, 1992: 224). It is striking that within decades of Aikenhead's execution, the more liberal climate of the Scottish Enlightenment made it permissible for David Hume to express highly sceptical and contentious views on religion (Hume & Millican, 2007: Sect. X).

Scottish universities at the turn of the 18th century bore some resemblance to religious seminaries for the grammar-schooled sons of noble, landed or professional men who were necessarily conversant in Latin when they matriculated (Devine, 2012: 98). Many students were destined for careers in the clergy, the legislature or the judiciary, and the universities obliged by providing what Nicholas Phillipson described as "the necessary godly education for the newly reformed state." (Phillipson, n.d.: 3). Phillipson describes the pre-Enlightenment pedagogical model of assigning each student a single "regent" who was responsible for teaching an entire four-year syllabus composed of "classics and scholastic philosophy, taught by rote and by disputation" (ibid.: 4). Gradually, pressure for structural and pedagogical reformation at St Andrews emerged, spurred by competition from more progressive Dutch universities such as Leyden and Utrecht. St Andrews faced additional challenges from its relatively isolated geographical location, which lacked proximity to "a bustling commercial,

legal or ecclesiastical life with which it could interact" (Broadie, 2018: 25-26), dampening the cross-fertilisation of ideas intrinsic in the societies and taverns of other Scottish university cities, not least Glasgow, as it responded to expanding trade with the Atlantic World.

A steady decline in the student population eventually led to calamitous financial difficulties and the dilapidation of the college buildings, culminating in the merger of St Leonard's and St Salvator's Colleges into United College in 1747 (Reid, 2011: 110). The collegiate amalgamation saved the University from dissolution and spurred significant changes in the professorial establishment, with professors specialising in different subjects replacing the outmoded regenting system (Allan, 2022: 101). The curriculum was broadened by the introduction of Chairs in Natural and Experimental Philosophy and Medicine, with teaching in English finally replacing Latin. As the Enlightenment gained traction across Scotland, there was also increasing demand for reform in the philosophy curriculum: Roger Emerson refers to one rusticated St Andrews student who, in 1735, had railed against the "useless and scholastic" classes in Pneumatics and Natural Theology, advocating instead the merits of scholarship in Mathematics, Moral and Natural Philosophy (Emerson, 2012: 446).

Given the combined handicaps of suspect political and religious affiliation, declining fortunes and peripheral location, it would have been entirely possible for the University of St Andrews to be bypassed by the Scottish Enlightenment. This is a commonly held narrative in mainstream historiography; yet, upon closer inspection, there were scholars at the university who actively embraced Enlightenment thought and made significant, though understudied, contributions. We can gain a more accurate understanding of St Andrews engagement with the Enlightenment through the works of four of its professors in this period: the philosopher Robert Watson (c.1730-1781), his successor William Barron (c.1740-1803), the scientist William Wilkie (1721–1772), and the mathematician, David Gregory (1712-1765).

Robert Watson

We shall concentrate primarily on Robert Watson, a quintessential 18th-century Scottish man of letters. Watson was a St Andrews graduate and Professor of Logic at St. Salvator's College, who then held the Chair of Logic, Rhetoric, and Metaphysics from 1756 to 1778 and was ultimately appointed Principal of United College in 1778 (Smitten, 2006). An accomplished polymath, he applied himself to theology, philosophy, history and belles-lettres. Like many Scottish literati (Reid, Blair, Ferguson[1] and Robertson), Watson was also a licensed Church of Scotland minister and member of its Moderate wing. Ironically, it was his lack of success in securing an appointment as minister to a St Andrews parish that was to propel him on a new course within academia. In addition to his lectures in philosophy, to which we will turn shortly, Watson achieved international recognition as a historian for his authorship of two volumes on the reign of Philip II of Spain[2]. Watson's profound interest in history is indicative of a broader component within the Scottish Enlightenment, which saw men of letters such as Hume and Robertson also publish acclaimed histories; an avenue of intellectual enquiry which Paul Bator (amongst others) characterises as an "impartial method for investigating the 'science of man'" (Bator, 1994: 73). Outside the lecture theatre, Watson proved himself an adept, outward-looking administrator who figured heavily in expanding the St Andrews University Library[3], awarding honorary degrees to Hugh Blair and Benjamin Franklin, and hosting Samuel Johnson and James Boswell when they visited St Andrews in 1773 (Smitten, 2006).[4]

Following his graduation with an MA in 1748, Robert Watson spent time in Glasgow and Edinburgh, where he is believed to have attended lectures by Adam Smith and become acquainted with many distinguished literati, including Henry Home (later Lord Kames). It was on Smith's transfer to the Chair of Logic at Glasgow in 1751 that Watson was enlisted

[1] Adam Ferguson was also a St Andrews graduate, awarded his MA in 1742.

[2] A further unfinished volume on Philip III was published posthumously in 1783.

[3] Library expansion at St Andrews benefitted from the 1709 Copyright Act, which designated it a Deposit Library, entitling it to receive a *gratis* copy of all new books published in Great Britain.

by Home to take over Smith's lectures on rhetoric at Edinburgh, which he undertook for five years before returning to St Andrews as the newly appointed Professor of Logic, Rhetoric, and Metaphysics in 1756. Watson was succeeded by Hugh Blair at Edinburgh, who took up the first Chair of Rhetoric and Belles-Lettres in 1762. Despite his reputation as an author of historical biography (and unusually among his peers), Watson published no philosophical works, which is undoubtedly the primary reason for the scholarly neglect of his name. It remains unclear why: despite there being

no printing press in St Andrews, Watson had existing connections with publishers in London and overseas who had administered his historical biographies. Fortuitously, Watson's teachings in logic, rhetoric and belles-lettres survive in the form of contemporaneous lecture notes written by Watson (Watson, 1756-1778) and transcribed by two of his students (Unknown, 1758 and Rintoul, 1762), which are preserved in the University of St Andrews Library Special Collections[4]. These manuscripts give a remarkably clear and invaluable insight into Watson's philosophical thought and pedagogical approach. It must be acknowledged, however, that these records are an incomplete record of what was articulated to students and are not equivalent to a printed publication intended for a broader audience akin to the more familiar works of Hume and Smith.

Appraising Watson as a Man of Letters

Watson shared a scholarly interest in the development and meaning of language with other Scottish literati, including George Campbell, James Dunbar, Adam Smith, Lord Monboddo and Hugh Blair. Bator points to many parallels between Watson's and Blair's pedagogy, suggesting significant mutual influence in disseminating their ideas, although Watson slightly predates Blair. Watson's short introductory course entitled "Lectures on Universal Grammar" opens by defining the topic as "that which without regarding the several idioms of particular languages respects the principles which are essential to them all" (Watson, 1756-1778, 1) Watson saw grammar as amenable to scientific analysis through decomposition into fundamental constituents, such as words and sentences, whose meaning and

purpose transcend linguistic differences between nationalities and eras. The term "universal grammar" here echoes that later referred to by George Campbell (Campbell, 1776, 100):

In propriety there cannot be such a thing as an universal grammar, unless there were such a thing as an universal language. The term hath sometimes, indeed, been applied to a collection of observations on the similar analogies that have been discovered in all tongues, ancient and modern, known to the authors of such collections.

In her comprehensive article on Watson's lectures, Rosaleen Greene-Smith Keefe advances the idea that he pioneered the teaching of "metaphysics as grammar" (Keefe, 2022: 133). Keefe highlights illustrative passages in which, for example, Watson instructs students that "all existence is either mutable as an object of sensation; or immutable as in the object of Intellection and Science" (Watson, 1756-1778, 2). In a similarly metaphysical vein, Watson contends that (ibid., 3):

as all speech is nothing else, but a publication of some energy or motion of the soul, and as the powers of the soul may be included in those of perception and volition, all sentences are either those that express a perception or those that express a volition.

According to Bator, Watson's teaching on linguistic development and grammar is typical of his time. It suggests it may owe much to Smith's earlier work, with which Watson was self-evidently familiar (Bator, 1994: 82). Watson's experience in Edinburgh delivering Smith's lectures also manifests itself in several passages discussing the notion of sympathy (Watson, 1756-1778: 159-60):

Another principle against the influence of which in our search for truth, there is equal reason to be upon our guard, as against the influence of passion is that of imitation or Sympathy, by which is meant that disposition or propensity in man to enter into and participate of the perceptions, feelings and passions of others.

Keefe argues that although Watson concurs with Smith's belief in sympathy as being the foundation of moral approbation, he also entertains

later Enlightenment thinking in believing that passions can lead us astray (Keefe, 2022: 131) and consequently, sympathy should be "kept within proper bounds [...] always remembering that still higher respect is due to truth and virtue than to the opinion, prejudices and practices of other men" (Watson, 1756-1778: 161-62). Notwithstanding debate about the degree of originality, this material provides ample evidence of alignment with Enlightenment thinking at St Andrews.

The compendium of Watson's notes includes a more comprehensive volume entitled "Introduction to and Lectures on Logic." Logic is introduced as the "rules and doctrines to assist us in the search after truth; it may be considered as an introduction to the other arts and sciences" (ibid.: 37). Watson relays his epistemological account of human understanding with a strikingly Humean explanation of perception (ibid.: 42):

All perceptions may be divided into two sorts, simple and implex. Implex perception is called by that name because in representing an object, it implies or involves its existence, truth and reality, whereas simple perception is a bare idea or notion of an object, without any such complications. When we see a man or hear thunder, our perception is implex, but when we barely think of those objects, as when the words man and thunder are pronounced in our hearing, they are simple.

Hume is cited again in Robert Watson's chapters on evidential theory, where his students are instructed that "all the objects of human knowledge are either matters of fact or general abstract truths" (ibid.: 116) and then, more critically, in an exposition of the question of uniformity in nature (ibid.: 120-123):

…there are innumerable future events of which they do not entertain the smallest doubt such as, the Sun will continue to rise, that all men shall die […] experience informs us that these things that have always happened in [the] past[,] on which account we do believe that they will continue for the time to come; according to Mr Hume no account of the matter can be given but the influence of Custom, but as the author himself observes that Custom produces a propensity to renew the same act or operation, whereas in the case

in hand those acts and operations to which we have been accustomed are different from those to which we feel the propensity.

[…] The Author of Nature has implanted in man a strong sense of uniformity in works and the course of Nature.

In his rejection of Hume's reliance on "custom" and, more generally, his sceptical position on causality, Watson aligns himself with other Scottish philosophers, notably Hutcheson and the Realist school of thought advanced by Reid, Ferguson and Stewart, whose anti-sceptic thinking was strongly influenced by their religious convictions (Bator, 1994: 82). Likewise, the abundant lecture time Watson devoted to evidence and testimony underscores his overarching commitment to the empirical and scientific methodology pivotal to Scottish Common Sense philosophy.

The final and most revisionary volume within the compendia of Watson's lectures concerns rhetoric, introduced as (Rintoul, 1762: Part 1, 1-2):

The first Thing to be done in every Science, is to fix the Notion of the Science itself. In order to fix the Notion of Rhetorick, let me observe the chief Particulars in which it seems necessary to find Fault with the common Writers on Rhetorick, is for confining their Precepts to one particular Sort of Discourse viz; Public Orations. First because many of the Rules of this Art are of a General nature, and therefore ought to be delivered as general. And Secondly Because an Acquaintance with the Rules of History, and Poetry, is at least of equal consequence to the Improvement of Taste, and an Acquaintance with the Rules of Orations.

According to the following plan, Rhetorick may be defined to be "The Art, which delivers Rules for the Excellence and Beauty of Discourse" […] By the rules of Rhetorick, or fine writing, nothing else is meant but observations concerning the particulars which render discourse excellent and useful […] To what follows then you may give the name of criticism or Rhetorick, for if it deserves one it deserves the other.

Beyond prosaic instructions concerning correct grammatical usage lie more fundamental intellectual reflections on literary style and criticism. Watson guides his students through critiques of exemplary classical and contemporary literature: Shakespeare's Othello illustrates the "remarkable […] effect produced by similes, metaphors and allegories" (ibid.: 70), while he praises the elegant manners in the writings of Pope, Swift and the Whig essayist Joseph Addison (ibid.: 12). Watson is concerned that "the smoothness of words [be] round and full, because they are at once agreeable to the ear, and are pronounced with facility and pleasure" (ibid.: 6). He also entertains the idea, analogous to Adam Ferguson's later account of climatic influence on societal development (Ferguson, 1768), that "the harshness, that takes place in some languages more than others has been ascribed to the different constitutions of the people who first formed them and these it has been alleged have been influenced by the Climate" (Rintoul, 1762: Part 1, 7).

Robert Crawford highlights that Watson's teaching of rhetoric was the first example in English-speaking pedagogy, where the classical term "rhetoric" became synonymous with the modern discipline of literary criticism (Crawford, 1997: 3). Situating rhetoric within non-persuasive belles-lettres subordinated entirely in Watson's teachings the traditional emphasis on oratory that had been so characteristic of other Scottish rhetoricians. Keefe goes further in singling out his elevation of poetry to the "apex of the language arts" as the most salient strand within his philosophical thought. Watson considered poetry "that species of discourse in which the Author does not confine himself to the description of real objects, but forms or creates objects for himself" (Rintoul, 1762: Part 2, 1). In this sense, poetry becomes a belletristic vehicle for creating mental images and stimulating passions more potent than we encounter in everyday life, allowing us to contemplate and perfect our emotional responses.

A related theme in Watson's intellectual pursuit is his concern with the refinement of taste. This is most striking within Chap. 2 of his Treatise on Rhetorick, where he argues that among the several advantages to be drawn from applying the "Rules of Rhetorick" are (Unknown, 1758: Chap. 2):

[Firstly] that they improve our Taste. By which is meant that our Discernment of the good and bad qualities of discourse is rendered more just, lively and penetrating […] Secondly, because they exercise or employ our Taste which is manifestly the best way of improving it […] we are therefore enabled to write with great Justness, Eloquence and Politeness. [Thirdly] that the Improvement in Taste is nearly connected with Improvement in Virtue.

Watson's words here resonate with the popular Enlightenment sentiments espoused by Hume, Gerard, Blair, and others, that a heightened appreciation for the aesthetic qualities of fine literature will inculcate readers with the delicate taste expected of them in a virtuous, polite society. Watson's admiration for English writers has been noted by previous scholars, who have alluded to this emphasis being designed to equip students in navigating the incipient North British society (Crawford, 1997: 124), where uncouth Scottish provincialism might handicap cultural self-improvement and upward social mobility amid a climate of febrile English "Scotophobia" in the 1770s (Devine, 2012: 28-29). However well this approach may have aligned itself with the prevailing zeitgeist, it did not escape criticism: the Scots vernacular poet Robert Fergusson[1] excoriated Watson's anglophile leanings in a satirical poem while an undergraduate at St Andrews (Reid, 2011: 111).

Other St Andrews Literati

Although the foregoing has focused on Robert Watson, he was by no means unique among his contemporaries in forging Enlightenment thinking at the University of St Andrews. William Barron, Watson's successor to the restyled Chair of "Belles-Lettres and Logic" from 1778 to 1803, shared Watson's emphasis on literary criticism. So much so, that logic was soon relegated to the margins of his pedagogy. He ventured further into what would now be termed the teaching of creative writing and instructing his students in elocution to further their assimilation into polite society (Crawford, 1997: 10-11). Barron published two editions of synopses during

[1] Fergusson's work in Lallans Scots was a formative influence on Robert Burns.

his tenure at St Andrews and a final posthumous volume of his lectures in 1806.

William Wilkie was a contemporary of Robert Watson and a fellow Presbyterian minister who was appointed Professor of Natural Philosophy in 1759 with Watson's sponsorship. Wilkie's circle of friends beyond St Andrews included Hume, Robertson and many others through his membership of Edinburgh's Select Society. Despite his scientific background and reputation as a competent (though eccentric) professor, he is perhaps best remembered as a poet who penned a book of classically inspired moral fables and the epic poem The Epigoniad, which was enthusiastically praised by Hume but lambasted by the London critics (Sher, 2004: 1). In common with Sir John Sinclair and Lord Kames, Wilkie also applied his energies to another popular Enlightenment cause, agricultural improvement, earning the soubriquet "Potato Wilkie" for his endeavours in experimental moorland horticulture.

David Gregory held the Chair of Mathematics at St Andrews from 1739 to 1764. He was a member of the illustrious Gregory dynasty[1], which produced many noteworthy Scottish scholars, among them four successive generations of professors at St Andrews (Reid, 2011: 109). Gregory's papers held in the Special Collections at St Andrews contain randomly assorted mathematical formulae and household notes, but also an expansive unpublished essay on the Unity of Letters and the Sciences where he uses his knowledge of classical civilisation to theorise that the advancement of scientific knowledge from ancient times onwards is to some extent interdependent on an understanding of history, literature and philosophy (Gregory, 1760). Gregory further informs us that (ibid.: 2):

None but ages of ignorance and barbarism such as those of the decline of the Roman Empire could so far mistake the Sciences and the Belles Lettres, as to pretend to put barriers betwixt them… But what did not Letters and the Sciences suffer in consequence of their disruption; an absolute and general ignorance prevailed. Those who retained knowledge

[1] Alternatively spelt "Gregorie". The St Andrews Gregorys were distant kinsmen of another Enlightenment luminary, Thomas Reid.

enough to perceive the disorder, attributed it to the weakness of the human mind, to Nature's being exhausted, to the World's growing old; but in these latter times, Scaliger, Petau, Leibnitz, Newton, and many others have made it plainly appear, that the universality of knowledge to a certain point is common to every age and to every country, when the knowledge of languages, the taste of antiquity and the love of the Belle-Lettres are united to the study of the most exalted Sciences. Looking at this essay in isolation, one can only gain a tantalising glimpse of Gregory's aspiration to enlist alongside his contemporaries in the Scottish Enlightenment project.

Conclusions

The University of St Andrews was undeniably less influential during the Scottish Enlightenment than its rival institutions in Edinburgh, Glasgow, and Aberdeen. This should not, however, be allowed to obscure the evidence presented here, which suggests that the Enlightenment was actively embraced at St Andrews. This engagement was inevitably on a proportionately reduced scale, reflecting the University's small size and limited sphere of influence throughout the long 18th century. Despite the odds, St Andrews was home to a microcosm of philosophes conversant with intellectual thought across the wider Republic of Letters and disposed to contribute to this through their teachings and connections with other Enlightenment figures. This topic has long been subject to a scholarly lacuna arising from the meagre amount of published material, an understudy of the available archival resources and a myopia in mainstream historiography. The St Andrews professoriate, which included Watson, Barron, Wilkie, and Gregory, made little-recognised but valuable contributions to the Enlightenment project that warrant further scholarly enquiry. The most prominent among them, Robert Watson, left a valuable legacy of lecture manuscripts that intersect intellectual history and philosophical pedagogy. This is most evident in Watson's lectures on rhetoric, whose distinctive emphasis on literary criticism and belles-lettres justifies his place within the pantheon of Scottish Enlightenment literati.

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Climate Change in The Far North: Colonial Legacies & Differing Perspectives Amongst Inuit

Rowan Peattie [1]

Indigenous Inuit communities in Greenland, Canada and the US have endured complex colonial histories and suffer existing legacies that have resulted in a multitude of social and economic inequalities, including but not limited to low education level and high suicide rates amongst young Inuit. These inequalities are now increasingly exacerbated by human-induced climate change, the impacts of which are felt more acutely in the Subarctic and Arctic where warming occurs at an accelerated rate. Through the perspective of Paul Farmer's Structural Violence, as applied anthropologically, the inequalities and injustices of climate change and its relation to colonial legacies are laid bare. However, not all within Inuit communities share an 'apocalyptic' view of climate change. Some see potential benefits in the Arctic, particularly in Greenland where economic opportunities presented by global warming could bolster independence from Denmark.

Introduction

Climate change in the 21st century constitutes a significant threat to the wellbeing of people and communities throughout the world (Roscoe,

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2014; Broadbent & Lantto, 2016; Baer & Singer, 2018), but to Indigenous Inuit living across the Far North – who already feel its effects through, for example, the thawing permafrost beneath their homes, causing structural collapses (Marino, 2015) - it threatens life in this part of the world and, to some, their existence (Irniq, 2007; Fitzgerald & Watt-Cloutier, 2018). In the Subarctic and Arctic, global warming – on average – is occurring at a quicker rate than most any other place (Marino, 2015; Baer & Singer, 2018; Nuttall, 2016), and so concurrently Inuit are often labelled the 'canaries in the coalmine' of human-induced climate change (Irniq, 2007; Boucher, n.d.; Marino, 2015). Living on this climate change 'frontier,' the changes in the environment caused by global warming and changing weather patterns are so apparent and obvious to Inuit because of their dependence on and relationship with the landscape of the Far North (Irniq, 2007; Boucher, n.d.; Mercer, 2018). In the words of Inuk activist Peter Irniq (2007; 21.50): "Inuit are observers of the environment. This is because we survive from the animals and fish that live on this Earth. To us, survival has always been our priority, and to survive we needed the land and all of its renewable resources." Hunting and fishing for subsistence are not just a part of Inuit culture, but a necessary way of survival in a place where grocery prices are extortionate and unaffordable for most within communities that often suffer from unemployment and low wages (Boucher, n.d.; Krause, 2022). Climate change, then, directly threatens Inuit food sources by making the environment immobile for them (Irniq, 2007; Marino, 2015; Mercer, 2018) and endangering the species they rely upon in a multitude of ways (Boucher, n.d.; Irniq, 2007; Alaska Sea Grant, 2012).

Indigenous peoples' of the Far North do not in any significant way contribute to human-induced climate change (Krause, 2022; Marino, 2015; Baer & Singer, 2018, p.88), yet they are one of the first to face its most dire consequences in the form of forced displacement (Marino, 2015; Alaska Sea Grant, 2012), food insecurity (Boucher, n.d.; DW Documentary, 2022) and the loss of culture inextricably tied to the Arctic landscape (Marino, 2015; Irniq, 2007). Approaching this issue through the lens of Structural Violence – as articulated anthropologically by Paul Farmer (2004), highlights how the injustices of climate change reflect longstanding struggles imposed on Inuit

by colonial actors (Baer & Singer, 2018, p.87-100; Bradley, 2022; Krause, 2022; Perley, 2024). Western perspectives might view climate change as the modern day's first 'apocalypse,' but Indigenous peoples have already experienced something distinctly similar with the arrival of Europeans and colonisation (Perley, 2024; Krause, 2022).

But this discussion cannot be had without recognising that the Inuit are fundamentally a people of change, both through their experiences of colonisation but also their experiences of the landscape within which they live (Krause, 2022; Irniq, 2007; Henshaw, 2016). However, a crucial caveat to this recognition is the need to be reticent of the defunct and racist theory of environmental determinism when discussing experiences borne from living in a particular landscape, as it wrongly asserted that people were physically and mentally shaped by their environment (Peterson & Broad, 2016; Baer & Singer, 2018, p.8). Nevertheless, Inuit should not be seen as a people without autonomy, without the ability to make and instigate change. The systems of structural violence work against them in many ways, but they are navigating ways to both adapt to a rapidly changing environment and make use of it (Irniq, 2007; Nuttall, 2016). From Western or European perspectives, the Far North – suggested even by the phrase alone – is at the periphery of what constitutes the "centre" of the world and so the obvious and increasingly disastrous impacts of climate change on people there are a distant issue and generally not as keenly felt. But for the Inuit, the Arctic is at the centre of their world, which makes the impacts of climate change on this landscape profoundly tangible and ruinous (Marino, 2015).

Colonial Legacies & Inequalities in The Far North

Structural Violence is defined as: "violence exerted systematically, that is, indirectly, by everyone who belongs to a certain social order" (Farmer, 2004, p.307). Exploring human-induced climate change through the lens of structural violence contributes to the wider picture of the social machinery of oppression and is best done by looking back at the history of a place or people, in the case of the Far North, in this instance specifically the Subarctic and Arctic of North America and Greenland, a deeply colonial

history. Ethnographies have often not been through enough in their analysis of entrenched inequalities because "ethnographic work relies on conversations with the living" (Farmer, 2004, p.308).

Before the arrival of colonisation, Inuit in what is now Northern Canada and Alaska lived nomadic or semi-nomadic lives, but not, it is stressed, as a people without history (Bradley, 2022; Krause, 2022), with a need for an in-depth understanding of the Arctic environment for subsistence and survival (Irniq, 2007; Henshaw, 2016). As the Far North was subsumed into the colonial world (Marino, 2015; Krause, 2022; Bradley, 2022), the fur trade, occurring from the 16th into the 19th centuries, became the primary form of the exploitation of the Subarctic and Arctic environment, and indigenous peoples knowledge of fur-laden animals was appropriated through their employment by colonial agents like the Hudson's Bay Company (HBC) within the Hudson's Bay Region (Henshaw, 2016) - although they were typically paid far less than their European counterparts, and because they now spent the vast majority of their time hunting for the profit of the HBC or other fur trading companies, they were not hunting for food and often struggled with starvation (Black-Rogers, 1986). Nevertheless, Inuit found ways to adapt and survive in a transforming and increasingly colonial world, including establishing more permanent hunting territories and moving away from an essentially nomadic way of life (Krause, 2022). But what little self-determination and removal from colonial realities Inuit maintained during the onset of the fur trade was lost when forced settlement (Henshaw, 2016) and "violent acculturation", though, for example, residential schools (Krause, 2022), was conducted by colonial agents. Forced settlement in Canada in the 1960s (Henshaw, 2016) and elsewhere have locked Inuit into primarily sedentary lifestyles wherein they are often exclusively reliant on fossil fuels for energy and, in terms of the impacts of climate change, they are unable to move away from impending environmental disasters (Marino, 2015; Baer & Singer, 2018, p.95; Alaska Sea Grant, 2012).

While Canada and the US offer more overt examples of colonial disruption, Greenland's colonial legacy (though quieter) has also shaped the region profoundly. The status of Greenland as a colony of Denmark officially

ended in 1953, but Greenlandic peoples were not granted proper self-governance and determination until the 2008 Self-Government Act (Heinrich, 2022). During that interim period and beforehand, Denmark exploited Greenland's resources without Inuit consent (mineral mining, seal oil and fishing) and geopolitics; most notably after WWII, when the US and Denmark participated in a defence agreement that led to the establishment of multiple US Air Bases and the subsequent forced relocation of Inuit (Heinrich, 2022; DW Documentary, 2022). Perhaps unsurprisingly, the original negotiation did not involve Inuit or wider Greenlandic representatives. Although not on as profound a scale as in Canada and the US, the "Danification" of some Greenlandic children did occur in the 1950s, that is the imposition of Danish culture and language with the belief that this would facilitate the "modernisation" of Greenlandic peoples or Inuit (Heinrich, 2022). In a more general sense, Denmark ensured the relatively slow development of Greenland and withheld certain political options to ensure that Greenland remained dependent (Heinrich, 2022).

Overall, Inuit in Canada, the US and Greenland face a multitude of problems within their communities stemming from colonial legacies, as well as ongoing colonial or structurally violent actions. Low employment, low wages, and low education level intertwine with both Eurocentric ideas of what constitutes a successful person or community as well as being genuine issues that face these communities (Irniq, 2007; FRANCE 24 English, 2023; Krause, 2022; Marino, 2015). Other impacts are more socially devastating, such as drug and alcohol abuse, and high suicide rates, particularly amongst young people (Irniq, 2007; Boucher, n.d.). The self-determination of Inuit is evolving and growing, with milestones such as the establishment of the Nunavut Territory in Canada in 1999 (Irniq, 2007), and Inuit-led organisations like the Inuit Circumpolar Council (ICC), which advocate for indigenous needs and interests (Nuttall, 2016; Sambo Dorough and Hayward, 2022). This includes continual efforts to secure Greenland's independence from Denmark (Heinrich, 2022; ABC News, 2018; FRANCE 24 English, 2023). However, the social issues experienced within Inuit communities are deeply entrenched in the damage done by colonial legacies, and climate change promises to be another unjust challenge that these

communities must face, an issue that will likely complicate and exacerbate matters.

How Climate Change Exacerbates Inequalities

The Far North is warming quicker than almost any other place on the planet (Baer & Singer, 2018, p.88; Nuttall, 2016). This is primarily due to the dangerous positive feedback loop of polar amplification, wherein less snow and ice caused by warming temperatures exposes darker land masses which in turn absorb more heat (Alaska Sea Grant, 2012; Marino, 2015). Climate change and global warming are widely understood and accepted to be human induced, which is to say that the release of greenhouse gases from the burning of fossil fuels is what its primarily driving rising temperatures and shifting climatic conditions. This is a rare moment of general scientific consensus (Broadbent & Lantto, 2016) that further reflects the extent of the threat it poses to the health of ecosystems and environments throughout the world.

The human-driven nature of climate change indicates a need, from a social science standpoint, to be critical of who is releasing greenhouse gas emissions and who is suffering from the impacts. Examining this more closely lays out a situation in which industrial societies and greenhouse gas emitting industries are using the Earth's atmosphere and environments as waste disposal sites for the byproducts of production. Communities that contribute very little to and gain almost nothing from emissions, in this case, Inuit communities, are suffering the consequences (Baer & Singer, 2018, p.87). Baer and Singer (2018, p.87) argue that this is a form of environmental colonialism, which mirrors historical colonialism in that the natural resources of the world are being exploited much like the specific natural resources of, for example, Northern Canada in the form of fur-laden animals (Black-Rogers, 1986). In this sense, then, it can also be argued that the environmental element of colonialism has been central to it since its beginning, as control and exploitation of the environment and its resources appear to be a central tenant of colonial activity (Baer & Singer, 2018). Nevertheless, colonial legacies still shape and hinder the lives of Indigenous

peoples, and thus climate change and colonialism are seen to be inextricable from one another (Perley, 2024; Krause, 2022; Crate, 2022). The release of greenhouse gases into the atmosphere is an act of Structural Violence because it systematically complicates and, in some cases, ruins the lives of the already disadvantaged, and it does so because of the actions of industrial societies and their desire for resources.

The consequences of this in Inuit communities are multitudinous and far-reaching, but some of the starkest examples include emerging evidence that high suicide rates amongst young people are tied to the drastically changing Arctic environment caused by climate change (Mercer, 2018). Furthermore, changing landscapes prohibit the use of the Far North environment for subsistence. In communities like Koyukuk and Quinhagak in Alaska, the thawing permafrost is lowering the water table causing ponds that are invaluable and often the only source of greens to dry up, and food cellars dug deep into the permafrost are no longer cold enough to keep meat fresh (Alaska Sea Grant, 2012). The environment is changing so rapidly and dramatically around Inuit that it is becoming unrecognisable as rivers silt up from erosion caused by unusually severe storms and change course (Krause, 2022), snow and ice come later and less frequently, and hunters are falling through thin ice that was once navigable. Some lose their lives (Irniq, 2007; Mercer, 2018). Reliable hunting species have dwindled as they migrate North, particularly when it comes to fishing for subsistence (Alaska Sea Grant, 2012). New and increasing numbers of predators like the Orca threaten fish shawls and seals, the latter being a key source of nutrients in the Far North (Boucher, n.d.). The extreme storms and unpredictable erosion they cause on coasts and within river systems, which is often spurred on by the shifting and weakening ground caused by melting permafrost (Alaska Sea Grant, 2012; Marino, 2015; Krause, 2022), primarily impact Inuit through the destruction of their communities within these threatened areas or their forced relocation, often outside their land because they do not have the resources or funding to build new infrastructure and housing from the ground up (Marino, 2015, p.15).

In Greenland, there are similar ramifications for hunting and subsistence, and food security is a worrying issue across the Arctic for Inuit

(Sambo Dorough & Hayward, 2022). But the retreat of the formidable Greenland ice sheet is vividly painful for Inuk like Adam Lubert: “The ice melting touches my heart. It’s a fact that the ice sheet is melting, and the landscape is changing. Look around, it’s happening very fast” (ABC News, 2018, 27.57). Inuit are people of change and resilience, but climate change might be happening too quickly, and the effects may be too drastic to adapt to new ways of life in the Far North (Irniq, 2007; Baer & Singer, 2018, p.93). But despite the multitude of ways in which climate change promises to wreak havoc on Inuit lives and communities, not all share the perception of climate change as apocalyptic or dystopic (Perley, 2024): “Alaska will be warm again” (Bradley, 2022, p. 216).

Differing Perspectives in Greenland, Canada and the US

Despite the multitude of negative impacts, changing weather patterns and warming temperatures will have on the Subarctic and Arctic environment, Inuit are thinking of ways to make use of a changing environment. How people are impacted and shaped by climate change cannot be reduced to a rudimentary winners-versus-losers dichotomy: “to imagine that global warming is a game of ‘winners’ and ‘losers’ may be the surest way to make losers of us all” (Cobb, 2006, cited in Baer & Singer 2018, p.99).

Because of Greenland’s move towards becoming an independent nation-state (Heinrich, 2022), there is distinct interest in the economic opportunities presented by a warming climate and changing environments as they could serve to bolster efforts to secure independence from Denmark (Nuttall, 2016; FRANCE 24 English, 2023; ABC News, 2018). Greenlandic peoples are “literally warming to the idea of less snow and ice” (Nuttall, 2016, p. 295). Underneath the Greenland ice sheet there are expansive deposits of minerals and petroleum that could prove economically invaluable, and as temperatures increase and the ice retreats a new industry is emerging in Greenland (Nuttall, 2016). The commercial fishing industry – which has been the mainstay of the economy since it began to develop separately from Denmark (Heinrich, 2022) – is set to benefit from higher fish

stocks due to warming and increasingly nutritious waters caused by melting ice caps, and there has been an increased presence of profitable fish like mackerel and bluefin tuna (ABC News, 2018). A farming revolution began in the South from the 1990s onwards and has since grown as the climate becomes more temperate and suitable for commercial agriculture (ABC News, 2018; FRANCE 24 English, 2023). Agriculture in the Subarctic and Arctic not only represents a growing industry driven by climate change but also increases access to fresh vegetables and fruits that are usually unaffordable or unavailable in Far North supermarkets (Boucher, n.d.). But the unpredictable and irregular nature of climate change has made this an unreliable venture, illustrated by the experience of Greenlandic farmer Ferdinand Ediger who originally did not believe that climate change was caused by greenhouse gas emissions, but later changed his mind when he saw the impact it was having on his crops (ABC News, 2018, 17.25). Increased tourism is another economic opportunity presented by the warming Arctic, wherein Inuit hunters who have an in-depth understanding of the Arctic environment have transformed into tour guides – like Martin Madsen (FRANCE 24 English, 2023, 14.18). As it seeks to grow an economy capable of supporting an independent nation, Greenland's government has requested that they be allowed to increase their greenhouse gas emissions by 1500% to sustain a program of rapid industrialisation (Baer and Singer, 2018, p.96).

It is, however, important to be reticent of the fact that every action and decision in the Far North is tinged with coloniality, including the pursuit of economic opportunities in the face of climate change which is rooted in the Subarctic and Arctic being perceived as frontiers of opportunity (Bradley, 2022), a lasting impression borne from colonial legacies and histories.

In Alaska and Canada, there is less optimism about making use of the changing environment, perhaps because they would not directly or even indirectly benefit from emerging economic opportunities due to being part of wider nations that have a history of structurally violent actions against the Inuit and, more broadly, indigenous peoples (Black-Rogers, 1986; Irniq, 2007; Fitzgerald and Watt-Cloutier, 2018). The benefits that are perceived are less economical and are usually rooted in subsistence and hunting and fishing practices (Alaska Sea Grant, 2012; Irniq, 2007; Mercer, 2018). Later

freeze-up has meant that there is more food available (Henshaw, 2016), Arctic agriculture has begun to develop in Alaska to diversify indigenous diets within Inuit communities (Bradley, 2022), and the migration of fish north has opened new species in large quantities like Arctic Char (Alaska Sea Grant, 2012). In Canadian and Alaskan Inuit communities there is more focus on adapting, particularly when it comes to moving away from fossil fuel dependency as the cost increases and the industry becomes more volatile (Irniq, 2007). Alternative, renewable energy sources like wind and solar energy are being trialled with some success (Henshaw, 2016; Irniq, 2007).

Throughout the Far North, Inuit communities face the geopolitical and capitalist ramifications of retreating sea ice and thus new frontiers of opportunity and conflict (Boucher, n.d.; DW Documentary, 2022). Increased commercial ship traffic as Far North waters become more navigable will increase pollution in Arctic environments – whether that be through potential oil spills or noise pollution, which could harm the marine mammals that are often a key source of food and nutrients for Inuit (Boucher, n.d.; Marino, 2015). Geopolitical tensions, perhaps like the ones that occurred in Greenland after WWII (Heinrich, 2022; DW Documentary, 2022), also complicate the future of the Far North, as nations seek to lay claim to an emerging space of profit and exploitation. How the Inuit will be involved in these tensions remains to be seen, however, there are already some hints. The Arctic Rangers are Inuit who patrol Arctic Canada for the Canadian Royal Navy and teach army and naval officers how to navigate and survive in the Arctic environment (DW Documentary, 2022). This exploitation of Indigenous knowledge of the landscape, done for the benefit of military operations seeking to stake a claim to the Arctic, is strikingly like the exploitation of Indigenous knowledge of fur-laden animals for profit during the early colonisation period (Black-Rogers, 1986; Krause, 2022). It draws into sharp focus again that almost all action nation-states make towards Inuit is ripe with structural violence and exploitation, and echoes consistently patterns of coloniality that have existed since Indigenous people's first 'apocalypse:' the arrival of Europeans and colonisation (Perley, 2024; Krause, 2022). As the planet moves into a future shaped by climate change, this will be increasingly plain to see and will complicate and compound the

multitude of ways in which changing weather patterns and warming temperatures will wreak havoc on Inuit ways of life and being.

Conclusion

Colonial histories such as the fur trade in Canada and the US and the "Danification" of children in Greenland have left Inuit communities with complex colonial legacies, and they continue to experience ongoing colonial and structurally violent actions that have resulted in a multitude of social issues that are difficult to resolve in a system built against them (Irniq, 2007; Krause, 2022; Perley, 2024; Baer & Singer, 2018, p.87-100). Organisations like the Inuit Circumpolar Council continue to advocate for Inuit rights and ways of being to combat the struggles faced by Inuit communities (Sambo Dorough and Hayward, 2022), and work to shape the future of Inuit climate action and sovereignty. Nevertheless, climate change, argued by some to be a form of environmental colonialism (Baer & Singer, 2018, p.87), is filled with structural violence within itself and exacerbates the struggles that Inuit face. However, global warming and changing climates should not be approached from a winners-versus-losers dichotomy (Baer and Singer, 2018:99). Inuit, particularly in Greenland (Nuttall, 2016; FRANCE 24 English, 2023; ABC News, 2018; DW Documentary, 2022), are finding ways to make use of the changing environment around them, both economically but, more broadly in Canada and the US as well, socially and for subsistence purposes (Irniq, 2007; Alaska Sea Grant, 2012; Marino, 2015; Bradley, 2022). Climate change could also become an invaluable driver of Indigenous sovereignty, particularly in Greenland, where the economic benefits have bolstered hope for independence from Denmark. Increasing resilience to a changing and rapidly more volatile world is also a priority as some Inuit communities seek to find ways of ridding themselves of fossil fuel dependency (Irniq, 2007). But all this still takes place in a globalised world (Baer & Singer, 2018). The Arctic promises to become a new 'frontier' of conflict and exploitation, a frontier in which the Inuit could become exploited and abused in a repeat of the 'apocalypse' of the arrival of Europeans and colonisation (Nuttall, 2016; DW Documentary, 2022).

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Magical Realism and Resistance against Ethnic Cleansing in Nalo Hopkinson's *Brown Girl in the Ring* and Nnedi Okorafor's *Who Fears Death*

Nikolas Pedersen [1]

This article examines Nalo Hopkinson's Brown Girl in the Ring *and Nnedi Okorafor's* Who Fears Death*, and the ways in which both authors incorporate elements of black and African cultures and folklore as a method of resistance against the erasure of minority communities. Furthermore, both Hopkinson and Okorafor utilise the aesthetics and conventions of magical realism and Afrofuturism, placing their novels within a legacy of post-colonial storytelling. By evoking these heritages and histories, both authors assert the permanence of black identities and cultures in the face of oppression and erasure. While Hopkinson's novel takes a pacifist view of resistance, depicting a future in which the preservation of marginalised identities will be enough to turn the tides of oppression, Okorafor's novel argues for active and aggressive resistance, asserting that the structure of society must be fundamentally reshaped for a more hopeful and equal future to be possible.*

Introduction

Through its examination and criticism of hierarchical political power structures, dystopian fiction has an innate connection to the modern post-colonial anxieties of minority communities. Many contemporary authors,

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through the use of typical dystopian genre signifiers, criticise the remnants of colonial power structures, which continue to victimise minority groups to this day.

In his essay 'The World and the Home', Homi Bhabha uses the image of the home to argue that contemporary African diasporic fiction often reflects the trauma of dislocation faced by black and African people, highlighting "the estranged sense of the relocation of the home and the world" (Bhabha, 1992, p. 141). Bhabha's emphasis on the home as a place turned against diasporic ethnic communities, specifically African and Caribbean victims of the Atlantic slave trade, expresses the authors' search for a new place and a maintained sense of community in the face of systematic oppression.

A recent wave of Afrofuturist fiction, including novels such as Nalo Hopkinson's *Brown Girl in the Ring* (1998) and Nnedi Okorafor's *Who Fears Death* (2010), has examined the attempts by colonial powers to wipe out ethnic minority communities and cultures. This is represented through dystopian futures, which centre the struggles of black and African communities suffering from the remnants of imperialist power structures in destroyed or deteriorating worlds. In centring these communities and incorporating magical realist elements through the portrayal of African and Caribbean folklore, both aforementioned novels examine how the preservation of community and cultural history can act as a form of resistance against oppressive power structures. *Brown Girl in the Ring* focuses on the Caribbean diasporic community of a dystopian Toronto, forced to live in the neglected inner city and cut off from state protection and resources. *Who Fears Death* ventures even further into the future, set in a post-apocalyptic Sudan, and focusing on the dark-skinned Okeke people as they face oppression, ethnic cleansing, and genocide at the hands of the fairer-skinned Nurus. Both novels take influence from real-world examples of systematic oppression stemming from centuries of colonialism; Hopkinson draws from the marginalisation of black people in North America, as well as the history of the Atlantic slave trade, while Okorafor, also touching on slavery, takes influence from a multitude of civil wars in African countries caused by destabilising colonial powers.

Through their dystopian settings, juxtaposed against their magical realist, Afrofuturist tendencies, both authors explore the dynamics between African and Caribbean cultures and the imperialist power structures of our post-colonial society. By presenting these communities as a place in which marginalised figures can belong and maintain their cultural heritage and history, Hopkinson takes Bhabha's image of the home turned unhomely and carves out a space in an estranged dystopian Toronto in which her Caribbean community can belong, resisting the neglect of the outer city's government. Okorafor, on the other hand, while still arguing for the importance of finding a home in a hostile environment, makes the case that when faced with systematic ethnic cleansing and genocide, maintaining cultural identity is impossible without active and violent resistance against one's oppressors.

Magical Realism and Afrofuturism

Taking influence from African and Caribbean cultures and folklore, Hopkinson and Okorafor create Afrofuturist settings, which they colour with magical realist tendencies. Both genres stem from post-colonial attempts at creating literary traditions outside the bounds of typical Western literature and exploring the ways in which they are intertwined can assist in reaching a better understanding of both novels.

Magical realism in its modern sense has its roots in mid-twentieth century Latin American fiction, as first identified by Angel Flores in his 1955 essay 'Magical Realism in Spanish American Fiction'. Shaped by authors such as Jorge Luis Borges and Gabriel García Márquez, Flores describes the genre as the "transformation of the common and the everyday into the awesome and the unreal" (Flores, 1955, p. 190). This transformation is achieved through the portrayal of magic and magical events, often bringing fables and folklore into a modern context. These supernatural elements are then treated by the author as if they were a part of our own mundane world. Lydie Moudileno argues that magical realism has found a place outside of Latin American literature, being adopted by African authors as it offers "a propitious means of liberating a new generation of African writers from the

French realist tradition that their predecessors had strived to emulate" (Moudileno, 2020, p. 68).

By adopting the techniques of the magical realist genre, Hopkinson and Okorafor are able to distance themselves from colonial influences, instead taking influence from Latin American and other African sources and creating a new, post-colonial literary heritage. Furthermore, by separating their stories from a grounded reality, both authors can explore Caribbean and African spiritualities and folklore in heavier detail, further centring cultural heritages typically erased from the Western mainstream.

This adoption of magical realism can be seen in the inner city of *Brown Girl in the Ring*, where the Afro-Caribbean community is under the control of the kingpin Rudy, who weaponises a duppy, a violent spirit, against his enemies. On top of this, protagonist Ti-Jeanne and her grandmother Gros-Jeanne both possess immense spirituality and a deep connection with various Caribbean folkloric figures. While apprehension towards this is present, particularly in the character of Tony, Ti-Jeanne's ex-lover, the power's legitimacy is never questioned; the only characters seemingly unaware of the presence of magic being the white Canadians from the suburbs. Thus, Hopkinson's magical realist elements are uniquely tied to the Caribbean culture she intends to highlight.

Who Fears Death's magical realist tendencies, on the other hand, are far more difficult to identify as, due to the post-apocalyptic setting, the novel appears to be more in line with the genre of high fantasy. However, through Okorafor's creation of a magic system deeply intertwined with African languages and folklore, as well as the constant reminders of the modern world in ancient computers and other references to modern technologies, the novel establishes itself as speculative fiction. Through this connection to modernity, the casual use of magic in various communities throughout the novel's epic narrative falls in line with the magical realist genre.

Along with this, both novels take aesthetic inspiration from African and Caribbean cultures in crafting their futures. This reimagining of science fiction through a pan-African lens is often termed as Afrofuturism and

decolonises the typically Euro/American-centric genre. Moudileno (2020) argues that:

> When magical realism segues into science fiction[…], the shift is more than narrative: What it achieves is a new representation of African historicity which not only reclaims the past, but also projects the continent into the future, a future which, in the case of Africa, has been famously denied by Western philosophy[…], impeded by colonization and arrested by successive dictatorial regimes (p. 74).

By focusing on these Caribbean and African communities and combining a magical realist representation of their folklore with science fiction worlds, these novels imagine a post-colonial future for black and African people, a future which, through oppression and erasure, has often been denied by imperial power structures. Both Hopkinson and Okorafor offer a hopeful future for the black and African diaspora, each of which will be explored, beginning with Hopkinson's dystopian Toronto.

Brown Girl in the Ring

In 'Blood, Soil, and Zombies', Sarah Olutola's examination of Hopkinson's *Brown Girl in the Ring*, the author states, in reference to the legacy of colonialism which provides the novel's backdrop, "The future of the necropolitical present has no room for black bodies that live with social, economic and political significance. Indeed, it is a future that would rather not imagine living black bodies at all" (Olutola, 2018, p. 65). In crafting her dystopian Toronto, Hopkinson presents a future in which the necropolitical power of the state manifests as a complete disregard for the health and preservation of black bodies and black cultures, with the Caribbean community of the city forced into the dilapidated, semi-flooded inner city, which they term 'the Burn'. Through this complete isolation of her central figures, Hopkinson reflects real world abuses and neglect of black bodies.

In order to fully explore how this is resisted by Hopkinson's characters, it is first necessary to examine the ways in which necropolitics –

the power to dictate who may live or die according to the state, as first theorised by Achilles Mbembe – are exerted over *Brown Girl*'s central community as a method of control and erasure. One example of this isolation is the treatment of state medical care. Early in the novel, the price for established medical care is demonstrated to be so high that only those desperately ill would ever send for it. On top of this, the doctors from the outer city are referred to as vultures, owing to the beak-like masks of their uniform: "If you saw a Vulture making a house call, it meant that someone was near death" (Hopkinson, 1998, p. 8). This highlights the predatory nature of the city's healthcare system, which preys on the weak for their money while ignoring the present needs of the inner-city community, forcing them to take healthcare into their own hands. In fact, the Angel of Mercy Hospital, which the vultures work for, is not only predatory in the monetary sense. Throughout the novel, the hospital is searching for an unwilling organ donor from the inner-city community for Premier Uttley, the city's head of government who refuses to accept an artificial heart transplant.. In this way, the city's governing body not only exerts necropower over their inner-city citizens, impersonally killing someone for the benefit of those in power, but also exerts biopower in the control and ownership of the city's residents' bodies, even in death. Every individual in the inner-city community lives a bare life in which they can be sacrificed against their will for the benefit of those in more fortunate positions.

In order to collect this heart, the hospital turns to Rudy's crime syndicate within the Burn. While Rudy takes control of the inner city in response to the power vacuum left behind by the withdrawn Toronto government, by assisting in the preservation of Uttley's health, he becomes an extension of the racialised oppression of the Caribbean diasporic community.

Rudy turns traditionally Caribbean forms of magic against the people of the Burn. The magic present in Hopkinson's novel takes influence from the Caribbean healing and spell-casting tradition of obeah, "a set of hybrid or creolized beliefs dependent on ritual invocation, fetishes, and charms" (Olmos *et al.*, 2003, p. 131). Obeah derives from a mix of various

African religions and beliefs, shared and combined by African slaves taken to the Caribbean islands. While obeah traditionally can be used benevolently or malevolently, it is notable that Rudy's use of it is entirely in assistance of his oppression of the Burn. For example, Rudy uses his duppy – a ghost or spirit in Caribbean folklore – to assassinate his rivals. As well as this, Rudy is depicted as zombifying members of the Burn community to act as his slaves. The origins of the zombie can also be traced back to Caribbean folktales, where it reflected a growing anxiety of slavery in a colonial world (Embry *et al.*, 2008). His duppy is notably revealed to be the captive soul of his daughter, accentuating the themes of slavery. Moudileno argues that this example of Caribbean culture weaponised against the inner-city community "highlights the ways in which cultural appropriation of Afrocentric culture helps perpetuate a larger systemic cycle of violence that erases black pasts while collapsing black futures into an uncertain present" (Moudileno, 2020, p. 64). By turning Caribbean folklore against the Burn, Rudy becomes an assistant in the attempted erasure of black bodies, a more active element in the government's systematic denial of aid. Mbembe puts forward the transformation of necropolitical bodies into 'the status of living dead' (Mbembe, 2003, p. 40) as a key aspect of the exertion of necropower. While the Toronto government of *Brown Girl* does this through denial of healthcare and the use of black bodies as nonconsensual resources, Rudy does this in a more literal sense, zombifying them and turning Caribbean magic against them.

In response to the necropolitical power of Premier Uttley and the Angel of Mercy hospital, the inner-city community finds its own methods of survival through Caribbean tradition. Ti-Jeanne's grandmother, Gros-Jeanne, who acts as the Burn's healer, exemplifies this by using herbal medicine and her obeah knowledge to heal the ailing members of the community. The first chapter of the novel depicts Ti-Jeanne picking up a book titled *Caribbean Wild Plants and Their Uses* to assist in her grandmother's medicine. This creates an inextricable link between Gros-Jeanne's healing practices and the Caribbean heritage of the Burn, establishing that the preservation of their community is contingent upon the continuing usage of their traditions. Ti-Jeanne notes that "among Caribbean

people, bush medicine used to be something private, but living in the Burn changed all the rules" (Hopkinson, 1998, p. 14). This demonstrates that in the face of oppression, the Caribbean community of the Burn has become more interconnected and communal, sharing their knowledge and culture in an attempt to keep it alive beyond their individual capabilities. For example, Gros-Jeanne makes an active effort to pass down this esoteric knowledge to Ti-Jeanne so that she may take on the same role upon her grandmother's passing. This communal sharing of healing wisdom and traditions has its roots in Caribbean history as a method of resistance and rebellion against slavery during the colonial control of the Caribbean. Monica A. Coleman (2009) explains that

> obeah was used to both heal people and to rebel against slavery […] Obeah is understood as the source of knowledge for slaves who poisoned their masters with poisonous herbs, or ground glass into the masters' food […] Slaves did what they had to survive, using the resources at their disposal. At times, their survival meant healing their wounds and illnesses. At other times, herbal knowledge was one of their strongest weapons against slavery. For the cause of survival, the slaves came together to pool their knowledge (p. 4).

While the obeah healing of Gros-Jeanne demonstrates a preservation of Caribbean culture, Ti-Jeanne utilises her obeah powers to combat Rudy and his gang more aggressively, much like how obeah was used as a method of violent resistance against slave masters. Ti-Jeanne does this through her spiritual connection with 'the Prince of the Cemetery', which is explained by Gros-Jeanne to be an aspect of Eshu, a trickster god derived from the Yoruba religion. This adoption of African religious figures is also explained by the amalgamation of African religions and beliefs, which gave rise to obeah and other Caribbean beliefs, and by defeating Rudy through these traditions, the novel further advocates for the preservation of minority cultures as a method of resistance against oppressive regimes. Thus, through this preservation of culture, not only are the lives of those in the community spared and extended, but their futures are prevented from collapsing into an 'uncertain present'.

Ti-Jeanne's passivity in defeating Rudy is notable, however, as the various aspects of Eshu appear to drown him. Here, Hopkinson implies that the very existence and continuation of these traditions is resistance enough. The ending of the novel even directly appeals to the 'heart' of colonial power structures: Premier Uttley, with Gros-Jeanne's heart now inside her, becomes an amalgam of the two women, announcing intentions to make sweeping reforms ending the necropolitical abuses of the Caribbean community of the Burn. Hopkinson here again implies that the mere presence and maintenance of minority cultures is enough to eventually change the tide of post-colonial abuses of black and African communities, a sentiment which Okorafor's *Who Fears Death* disagrees with.

Who Fears Death

The post-apocalyptic world of Okorafor's novel, while not as closely tied to our current day as is usually expected in the genre of dystopian fiction, exhibits the same typical features, in particular, the necropolitical power of the Nurus over the precariat Okeke. The Nurus, in expanding their empire further into the East, are depicted pillaging Okeke villages, killing and enslaving the residents, and raping the women. An instance of this rape leads to the conception of protagonist Onyesonwu, whose lighter skin marks her as *ewu* – a child of rape – leading to Okeke society shunning her. This representation of wartime rape is vital to understanding *Who Fears Death*, as Okorafor credits the Emily Wax news story 'We want to make a light baby', which explores weaponised rape in Sudan, as creating "the passageway through which Onyesonwu slipped into [her] mind" (Okorafor, 2010, p. 389). Wax's article focuses on victim testimonies of rapes committed by the Janjaweed militia, highlighting that in Sudan "a child's ethnicity is attached to the ethnicity of the father" (Wax, 2004). This systematic rape was an attempt at ethnic cleansing by impregnating Sudanese women with children who would not be considered Sudanese. The influence of this story on Okorafor's writing can be seen in her depiction of the rape weaponised against the Okeke people, with *ewu* children being deemed naturally violent. Through this shunning of our protagonist, another layer of

precariatism is created, where Onyesonwu's skin marks her as outside both Okeke and Nuru society.

On top of this connection to modern Sudan, the Nuru and Okeke bear a resemblance to various other instances of ethnically motivated violence throughout Africa, such as the Hausa and Igbo of the Nigerian Civil War, or the genocide of the Hutus during the Rwandan Civil War. These examples of ethnicity-based violence in Africa can be traced back to divisions caused by the colonial control countries such as France and the United Kingdom had over early 20th century Africa, with these divides caused by arbitrary categorisations in colonial laws. Thus, by making these connections to post-colonial African wars, Okorafor uses her post-apocalyptic Sudan to explore the legacies of colonialism and the ways in which they have informed governance and conflict in modern Africa. This allows for discussion of the necropolitics of genocide, a systematic process which turns its victims into Mbembe's 'living dead.'

Through *Who Fears Death,* Okorafor encourages resistance against this oppression, in a similar manner to Hopkinson through the preservation of African culture, but also active retaliation. In tandem with *Brown Girl in the Ring*, *Who Fears Death* presents an amalgam of various African cultures and traditions, from the representation of spirits to its use of Nsibidi – an ancient form of writing hailing from Nigeria – as its magical script. However, like Rudy's exploitation of obeah magic, these traditions are a double-edged sword; Onyesonwu's father, the sorcerer Daib, utilises the same magic as the Okeke people in his oppressive regime, keeping a watchful eye over attempts at rebellion, and using his superior mastery of it to combat retaliators. The shared magical traditions of the Nuru and Okeke further highlight the similarities between their conflict and modern African conflicts, namely the artificial divides created by legacies of colonialism. This manifests in Okorafor's novel as the Great Book, an ancient text which asserts the Okeke's subordinate position, justifying centuries of oppression in much the same way as modern divides between Hutus and Tutsis, or Hausa and Igbo.

While the magical elements allow for the preservation of the Okeke people's livelihoods and culture, the sharing of this magic with their

oppressors makes the more passive resistance of Hopkinson's novel impossible, and instead, the characters are forced to take more active resistance measures. Arit Oku argues that "Okorafor uses the tool of speculative fiction to showcase alternative pathways for Africa's post-crisis development and economic prosperity, enabling one to focus on astonishing future possibilities rather than the excruciatingly painful present" (Oku, 2021, p. 85). This is seen in the ending, where Onyesonwu rewrites the Great Book using the Nsibidi script, revising the foundations upon which her society is built. This leads to a more hopeful and equal future and prevents Onyesonwu's prophesied death. Rather than the Okeke people remaining locked into oppression and ethnic cleansing, the imperial power structures are removed, and new future possibilities become available, preventing the collapse of black futures into an uncertain present. By overriding the set-in-stone systems of oppression by using ancient African script, Okorafor argues that the implicit imperial systems left behind by colonialism can only be overcome, and a better future is only possible by shedding them completely and replacing them with a system which centres the people it is serving.

Conclusion

Hopkinson and Okorafor tackle their dystopian worlds by focusing on oppressed, racialised communities. By centring these communities, both authors represent African and Caribbean cultural lineages, showing how the preservation and sharing of such cultures are vital in combating their erasure. The novels take influence from colonial oppression, with Hopkinson's characters mirroring ways in which African slaves resisted their captors, and Okorafor's post-apocalyptic world examining the modern-day divides throughout Africa left in the wake of colonial powers. Both Ti-Jeanne and Onyesonwu create "a house where the unhomely can live" (Bhabha, 1992, p. 142) through their use of magic taken from African folklore, combating the displacement caused by the necropolitics directly targeting their communities. However, Hopkinson advocates for reform from within the system, remaining hopeful for the future of black people within current political systems. Okorafor, meanwhile, argues that the necropolitical abuses

of minority communities are engrained in post-colonial political systems and will remain ever-present as long as these systems are in place, making the preservation of these communities impossible without immediate and radical change.

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Music's Lead Role in *Deception* (1946): How Score Underlines Character and Narrative Development

Jonathan Love [1]

Irving Rapper's Deception *(1946) recounts tensions between European high culture and post-war American mass culture, while concurrently shining a light on gender dynamics and patriarchal authority. Erich Korngold's score for the film functions beyond atmospheric and scene-building accompaniment, frequently being used by the characters to engage with those around them. This essay delves into how Deception's score contributes to narrative depth, particularly through two diegetic moments: Christine's defiant performance of Beethoven's Appassionata, and the climactic premiere of Hollenius's (Korngold's) Cello Concerto. Both scenes demonstrate the protagonist's limited agency in a male-dominated world, demonstrating how music operates as a mediator of sorts in between acts of power, defiance, and moments of emotional turmoil. In summary, this essay argues that Deception exemplifies film music's capacity to function as an active force, shaping narrative, character psychology, and broader societal discourse.*

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Introduction

Music in film serves a variety of roles. Among them, it aids in understanding character and place, developing and furthering narrative, deepening audience engagement, and tying together thematic material, commonly becoming symbolic of the film to the levels of its principal characters. Music acts as a pen to the film's paper, underlining and subtly annotating elements that may not be immediately visible, but lend much insight into the film's world. This is particularly evident in Irving Rapper's *Deception* (1946), in which the score aids in comparing the worlds of high-class European concert music with the mass culture of the 'new world'. In parallel, the score explores the patriarchal roles of two 'powerful' (though decisively flawed, each in their own ways) men with contrasting influences over a woman's life and career, illustrating the complex dynamics and gender tensions of the post-war era.

Deception is Rapper's noirish (of, or associated with, film noir) melodrama, revolving around a love triangle of former lovers Christine Radcliffe (Bette Davis) and Karel Novak (Paul Henreid), and Christine's patron and recent love affair, composer Alexander Hollenius (Claude Rains). The film itself focuses on the Classical music world, portraying it as a vicious amalgamation of haughty European high culture and the hustle and bustle of post-war America, drawing for its score from many greats of composition, including Wagner's *Bridal Chorus*, Schubert's Symphony No.8*,* and Beethoven's Piano Sonata No.23 ("Appassionata"). The soundtrack's original works, including the Hollenius Cello Concerto on which the film's second half focuses, were composed by Austrian composer Erich Korngold. A self-proclaimed admirer of Strauss (evident from his lush, expressive, late-Romantic style), Korngold was a celebrated composer in both Western art music and Hollywood, despite the frequent spats between the two spheres. Korngold, however, made it clear around the time of *Deception's* release that he was dissatisfied with writing film music and wished to return to more 'serious' music (Goldmark and Karnes, 2019, pp. 247-254) (After the release of *Deception*, Korngold released the Hollenius concerto as his own Op.37 Cello Concerto in C Major), with *Deception* released near the end of his compositional career in Hollywood.

The film's original score and the pieces drawn from elsewhere unequivocally lend substantial context to *Deception*'s characters, narrative and place, providing the audience with windows into our main trio's physical, emotional, and mental states. This analysis will examine how *Deception*'s score not only underlines narrative elements and provides insight into its characters but also frequently comments on the dichotomy of European high culture and new world mass culture, as well as gender dynamics in the post-war era and their depictions in Hollywood. This is particularly evident in two scenes: the wedding party, in which Christine plays the *Appassionata* before being interrupted by Hollenius smashing a wine glass in anger and jealousy, in which the music underlines the first on-screen moment of tension between Hollenius, Karel, and Christine. The second is the performance of Hollenius's concerto, as Christine grapples with the immediate aftermath of killing Hollenius while at her husband's premiere of the composer's work. Interestingly, both examples are diegetic. A film centred on musicians, *Deception*'s soundtrack is not just background, but an active player in the characters' lives. These scenes demonstrate two instances in which *Deception*'s score functions not only as background but is wielded effectively as a powerful diegetic force that deepens narrative, character, and place, emphasising a film score's power to convey complex themes and narrative material to the audience.

Hollywood's 'Golden Age' of Music

Deception's release falls amid a 'Golden Age' of music in Hollywood film, during which a veritable "musical gold rush" (Handzo, 1995, p. 47) of composers flocked to Hollywood. The generally accepted span of this 'Golden Age' falls between the mid-1930s and the early 1960s, during which many iconic composers of film, such as Max Steiner, Bernard Herrmann, and Korngold established their careers. Warner Bros., the studio behind *Deception,* which frequently brought on Korngold to score films, was pivotal in shaping this era of film music, nurturing composers like Steiner and Korngold and producing films that relied heavily on their powerful scores and popularised the use of leitmotifs and emotional underlining in film

(Carroll, 1997, pp. 269-270). The studio provided a strong degree of creative freedom to the composers, allowing them to draw heavily from their Classical backgrounds, particularly from opera. The importance of music to film was being realised, reflecting the score's ability to "create a second film, parallel to the main narrative" (as put by Raúl Ruiz in his biographical extra on the DVD of the 1982 film *Three Crowns of the Sailor*) (Prieur, 2006) and develop and elevate narrative elements.

The scores of this time were often influenced by Romantic-era music as many composers and directors immigrated from Europe, some of whom were forced to flee due to the rising tensions and conflicts in Nazi-occupied parts of the continent. Among these émigrés was Korngold, already a celebrated composer in Austria, who made his journey to America to escape the persecution of Jews in the mid-1930s. Drawing on their European influences, where art music and the concert hall were still the prevailing style and performance venues of music, many of these composers influenced their Hollywood scores with the emotional depth and intensity so typical of late- and post-Romantic composers. The works of Mahler, Wagner, Strauss, and Tchaikovsky frequently shaped scores, with concepts imbuing the music of the likes of Steiner in *Gone with the Wind* (1939) and Korngold in *The Adventures of Robin Hood* (1938) and, of course, *Deception*. Among these ideas brought to Hollywood scoring was the Wagnerian concept of the leitmotif, a theme associated with some aspect of character or narrative, brought to America and pioneered by Korngold.

Scene 1 – Beethoven's Piano Sonata No.23 ("Appassionata")

Within its first third, *Deception* lends one of its starkest insights into the complex relationship between Karel, Christine, and Hollenius. The wedding party scene, specifically Christine's performance of Beethoven's *Appassionata* (Rapper, 1946, 27:10), reveals her complex entrapment within a patriarchal structure, where her limited musical and social agency comments on narrative, her character, and broader gender constraints and tropes in post-war-era Hollywood films. Earlier, Hollenius makes a dramatic entry at the wedding party, making evident his disdain for Karel and

Christine's marriage. His egotism and deluded, control-oriented idealism is evident as he remarks to Christine, "You'll realize that nothing really matters but music; everything passes by music – and me" (Rapper, 1946, 25:45), going on to suggest that Christine plays something 'pathetic' or 'tender' for the attendees. Karel and Christine instead decide on the *Appassionata:* a far more dangerous choice that challenges Hollenius's patriarchal authority over his protégée. This is observed in depth by Peter Franklin, commenting on how Christine at this moment is "Quite literally performing the gendered musical threat to male self-control", (Franklin, 2011, pp.115-137) constraining the unapologetically sexist composer to his chair during the performance. Brooding and jealous, Hollenius does not allow Christine to get far in the performance before smashing his glass in his hand, halting her performance as she runs over to check on his wound. In response, Hollenius unleashes a barrage of misogynistic insults towards Christine, before dramatically exiting.

The *Appassionata* acts as a potent symbol both of defiance and confinement, demonstrating Christine's entrapment in a patriarchal structure controlled by Hollenius in part, though also constraining her autonomy through her love and devotion to Karel. The *Appassionata*, with its technical difficulty and emotional intensity, is an apt representation of Christine's defiance and contrasts Hollenius's request for a 'tender' and 'pathetic' piece. In this regard, the performance shows a degree of agency that was perhaps unexpected at this point in the film – after a conversation of sly digs at herself and Karel, Christine pulls out a piece of great difficulty, to which Hollenius's response is crystal clear. The *Appassionata*'s history contains elements of defiance. At this point in his life, as is well-documented in the Heiligenstadt Testament (Cooper, 1995, p.19), Beethoven's hearing loss was significant. Despite existing during the Classical period, Beethoven's later sonatas contain great amounts of emotion, far more Romantic in style than Classical, that mirror his frustration at his hearing loss. While certainly not as 'Romantic' as Beethoven's final sonata (Sonata No.32 in C Minor, which contains almost ragtime-esque passages in its second movement), the *Appassionata,* which translates literally to "passionate", is a potent piece that

certainly parallels Christine's complex emotional state at this point in the film.

Despite *Deception*'s inherently musical nature, following a famed cellist, accomplished pianist, and renowned composer, the film provides an almost disparaging representation of Christine as a musician, with the audience only hearing her play on one other occasion in the film – a performance of an excerpt of Hollenius's concerto. The two male leads have ample opportunities to show off their skills while Christine is limited to two performances, both of which tie into her complicated relationships with Karel and Hollenius. Even within the wedding, despite the overt challenge to Hollenius's control over Christine, the choice of what piece to perform is offered by Karel. In choosing to perform the *Appassionata*, Christine demonstrates momentary agency, challenging Hollenius's control, though this is mediated by Karel's input. This reflects her desire for self-determination in a strongly patriarchal environment. Tying back to Hollenius's comments, Christine is demeaned on several occasions not for her musical abilities, but rather for her gender. In *Deception*, Christine's role as a musician is overshadowed by the presence of the men in her life, reflecting the trends of movies, particularly music-focused films, in post-war Hollywood. She is not characterised by her musical ability but rather by her relationships, with the music in the wedding scene underlining Christine's emotional expression and defiance while still stifling her level of self-determination in the overall narrative of the film. The *Appassionata* is the audience's first (and one of only two) demonstration of her ability, though Karel's input into the decision of what to play and Hollenius's dismissive and patronising comments demonstrate the degree to which her experiences and autonomy are subsumed by the weight of male authority.

Scene 2 – Korngold's Cello Concerto, Op.37

Music's underlining of character, place, and narrative is further stressed immediately following the film's climax. Christine has just failed to attain any assurance from Hollenius that he will not expose their previous affair after the concert. She shoots him, leaving the gun in an attempt to frame

the death as a suicide before departing to attend the premiere of Hollenius's concerto (Rapper, 1946, 1:32:18). The piece, an original by Korngold, ironically continues the blurring of his attempt to return to more 'serious' composing. Hollenius and his concerto are the epitome of the 'traditional' composer and European high-class music – Hollenius, the immensely wealthy, self-absorbed, egotistical symbol of aristocracy and a culture that had not reached America from Europe and his concerto, featuring soaring melodies and harmonies that, as was apt at the time, occasionally diverge from functional tonality. Through it all, however, as put by Lawrence Leviton (1998, p.6), "[the concerto] follows Korngold's musical credo: melody and tonality remain ascendant". After much building up to the performance of the concerto, the audience is finally given the moment in which the much-mentioned concerto on which much of the film's tension is built – a piece that symbolises patriarchal European high-class music standing in direct opposition to the female lead's agency, trapping her between Hollenius's ever-present influence and her and Karel's growing anxieties over their relationship.

In the scene following the concerto's performance, the audience is prepared for a sorrowful conclusion to the film's plot. Hollenius has been murdered, and time may well be running out until his body is discovered and the police arrest Christine, providing us with a 'fallen woman' scene not uncommon in mid-20th-century Hollywood melodramas. However, Karel responds to Christine's admittance of guilt by suggesting the two run off, providing another cliché – the man corrupted by the femme fatale (Franklin, 2011, pp. 143-162). The concerto acts as a bridge between *Deception*'s apotheosis and dénouement, providing the moment of calm between the two storms of Hollenius's murder and Christine's tell-all to Karel following the performance.

Christine's reaction to this concerto, implicitly written with her in mind and routinely wielded so effectively as a weapon by Hollenius throughout the film, is very telling of her present emotional state. Her victory is hollow as she grapples with her actions, overcome with desperate resolve as she bounces between two states of mind. The first, palpable relief at her freedom from Hollenius's almost tyrannical hold over her. The threat of

reveal that led her to commit murder dies with Hollenius, and Christine is momentarily free from Karel's anxiety over her and Hollenius's relationship. The second, overwhelming dread at the thought of living with the consequences of her actions. The score itself here, acting as a requiem of sorts to the late composer, acts as a physical representation of her state as well. In Leviton's (1998, p.6) analysis of the score, he comments on how "the agitated character, plaintive melodies, ambiguous harmonic structure in the underscore [...] provide an emotional context for the turbulent relationships depicted in the story". This is very typical of the time, and the influences on Korngold's music mirror the nature of the concerto in the context of the scene. Some defining traits of late-Romantic music include a strong divorce from the constraints of the Classical (and to a greater degree, Baroque) era, with increasingly programmatic content and a growing emphasis on expanding the 'colours' of the orchestra. Korngold's music follows this trend, with Korngold himself referencing his admiration for Strauss from an early age and his influences from Puccini and fellow Austrian composer Zemlinsky while remaining distant enough from the influences of Berg and Schoenberg to reject the tonal experimentalism of the Second Viennese School (Benser, 1998, pp. 366-369). The concerto is a strong musical culmination of *Deception*'s plot, both in its influences and central role in the plot. It is difficult to imagine a piece of music drawing from any other period in music acting the role in the same way, with Korngold's music providing narrative and emotional complexity equal to that of the point in the film's diegesis.

Conclusion

To review, in *Deception*, music acts as a strong device in furthering the narrative and developing characters and placing them in the context of the film and broader societal trends. The film's soundtrack relays the emotional struggles experienced by its characters and the intricate interplay between Karel, Christine, and Hollenius as they each look to further their own goals. The performances of Beethoven's *Appassionata* and Hollenius's (Korngold's) Cello Concerto underline Christine's toils in a patriarchal

environment, demonstrating the limited agency imposed upon her from both directions in the love triangle. The *Appassionata* illustrates a limited but effective moment of defiance against Hollenius, showing off her abilities as a formidable pianist whilst underlining her limited autonomy, as the choice of piece was offered to Karel. Furthering the idea, the concerto acts as a haunting reminder of Hollenius, the man Christine has just murdered, providing Christine with equal measures of grief and relief as she grapples with what comes next. These moments are both immensely powerful and pivotal in the film, neither of which would be functional at all without the music driving forward the plot and development of the film's characters and diegesis. To conclude, *Deception*'s score contributes substantially to Rapper's melodrama, in that it provides far more context, deepens audience engagement, and provides a stellar example of music's role in film through Christine's endeavouring to navigate the patriarchal portrayal of the Classical music world.

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The role of the artist in relation to working-class Scottish places as depicted in Alasdair Gray's *Lanark* and David Keenan's *This Is Memorial Device*

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Through textual analysis of David Keenan's This Is Memorial Device and Alasdair Gray's Lanark, this essay aims to investigate how working-class Scotland is presented as an imaginative landscape for artists in Scottish literature. The comparison of the two novels explores this relationship of artist and place through different art forms. The story of This Is Memorial Device centres the postpunk music scene in Airdrie and how this community of artists fosters a sense of celebration and possibility in a small town on the fringes of this culture. In Lanark, post-war industrial Glasgow is initially portrayed as a place which inhibits the protagonist's ambition of becoming a visual artist. However, Gray's experimental narrative then reconstructs this imaginative relationship between artist and place within the text and presents creativity as a measure to realise a better future for Glasgow. The research concludes that both texts reveal the dynamic between artist and place in working-class Scotland as a relationship with transformative qualities.

In a well-known passage from Alasdair Gray's *Lanark,* Duncan Thaw explains the reason for Glasgow's unrealised greatness by declaring that 'if a city hasn't been used by an artist, not even the inhabitants live there imaginatively' (Gray, 1981, p.243). This sentiment illustrates the significant role of the artist in establishing a relationship with their environment, which

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subsequently identifies and fosters a sense of creativity and possibility. As an aspiring visual artist in Glasgow, Duncan Thaw's imaginative relationship with his city is restricted through Gray's representation of 1950s working-class Glasgow as a place 'lacking in human affection, freedom and creativity' (Falconer, 2012, p.172). The novel portrays his artistic isolation from the world around him and places his narrative into a wider social context, which is transformed through the fantastical landscape of Unthank, a dystopian vision of Glasgow. Conversely, David Keenan's novel *This Is Memorial Device* was written as an affirmative novel about the small-town experience, one which explored the 'absolute magic' of Airdrie (Smith, 2023). The text depicts a postpunk community of musicians and artists in Airdrie and how their engagement with this music facilitates a sense of imaginative possibilities in a working-class town on the fringes of this culture. This essay will examine the textual elements which explore how the imaginative relationship between artist and place is realised.

David Keenan states that the art projects featured in *This Is Memorial Device* are attempts by the characters to 'wake up to where [they] are and see the significance of the present moment' (Kimblin, 2017). Despite this, certain characters in the novel display a fixation on the future. This is expressed through their engagement with these art projects and the sense of possibility and anticipation fostered in Airdrie as a result. In the opening passage, Ross reflects on his reasons for documenting the scene and declares: 'I did it because back then anything seemed possible', further describing this time as the 'glory years'. This is then countered by his following statement: 'The glory years in Airdrie – what a joke, right? But really that would be untrue because back then everything seemed impossible' (Keenan, 2017, p.1). He details the significance of the postpunk culture in challenging this sense of impossibility, because 'even when everything seemed impossible, everybody was doing everything, reading, listening, writing, creating, [...] like the future was just up ahead and we'd better be ready for it' (p.2). Keenan describes this idea of creating the future in a town like Airdrie where it seems non-existent, stressing that it has to be built by those living there (Robb, 2022). In this respect, this depiction of the postpunk culture in the novel accurately reflects its ethos. As Reynolds (2005, p.24) describes it,

postpunk as a genre is 'constructive and forward looking', presenting a 'faith in a future that punk had said didn't exist'. Mark Fisher (2022, p.27) also highlights music culture's essential role in 'conjuring seductively unfamiliar worlds' but also states that this ultimately contributes to 'the projection of the futures which have been lost' (p.27). Fisher (2022, p.8) popularised the idea of the 'slow cancellation of the future' and relates this concept to the ever-developing popular music of the twentieth-century, which made it feel as if 'newness was infinitely available'. This is then followed by the subsequent arrival of a twenty-first century which is 'oppressed by a crushing sense of finitude and exhaustion' (p.8). Applying this idea to the personal reflections from the novel's artists regarding the scene in Airdrie reveals the disappointment of the anticipated future which never came. Ross concludes his effusion about the sense of possibility fostered in this time by declaring: 'And now already it's the rotten past' (p.2). This sentiment is further echoed by the character of David Kilpatrick, who states: 'I could barely wait for the future, which now, to me, is a horrible thought' (p.73). In another lamentation, Dominic asks Ross: 'Can music preserve a moment in time? [...] Do you think it can keep alive all the ideas that went along with it? Can it keep it young forever?' (p.248). This is reflective of Keenan's assertion that many of his characters fail to appreciate the present moment through the art as intended and can instead only do so through the memory of events long after they have passed (Doran, 2024). Despite this disappointment, the anticipation for the future in Airdrie, because of the sense of possibility postpunk offered, is a testament to how the artistic culture transforms Airdrie into an imaginative environment.

This idea of transformative encounters with art is central to the text. Keenan is especially concerned with how this is realised in a small town far away from any cultural centre (Doran, 2024). He explains to Garavelli (2022):

> 'The story of post-punk was never Siouxsie and the Banshees or the big bands that were in the NME; the real story was the kid who made one cassette, who pasted up posters round town once, who played a gig in Coatbridge once, but who believed enough that it changed their life.'

This sentiment is reflective of how Reynolds (2005, p.490) summarises postpunk as having 'the confidence that music can transform the world, even if only through altering one individual's perceptions or enlarging their sense of possibility. Reynolds (2005, p.12) also argues that 'revolutionary moments in pop culture' are most impactful after the ideas have passed from the metropolitan areas and reached the suburbs and regions. This transformative power of art in a small town is exemplified in the text by Robert Mulligan – known as 'Steel Teeth' in the local scene. He describes living in Greengairs as 'closer tae a state of suspended animation' and 'a series a frozen gestures caught between the impossibility of the future and the improbability uv the past' (p.114), thus suggesting a sense of liminality and a feeling of being stuck. However, in beginning to produce his own tapes, he feels he is 'bringin hings back tae life', the sound being like 'a cracking open o reality' (p.117). Robert stresses the idea that it felt like anyone could be an artist, stating: 'You wud think it would take a titan tae conceive ae it, an overlord tae live it, a gigantic courage just tae cast yourself into the watters. But really it doesny. It takes ordinary Joes (p.120). This relates to Keenan's own assertion that there is an urgency to create your own world when there is not a pre-existing cultural world around you (Robb, 2022). The idea raised by Robert that 'transgressive types' and 'avant-gardists' (p.120) were ordinary people also emphasises Keenan's argument that the postpunk scene developed a sense of permission to be an artist in small towns, where the assumption of working-class residents was that 'it's not for us' (Robb, 2022). The sense of permission and the transformative nature of art in the text suggest that the artists contribute to the imaginative landscape of Airdrie and thus foster a sense of creative possibility for the community.

The text's exploration of the artistic possibilities in Airdrie helps to illustrate Keenan's intention of opposing the clichéd idea of small working-class towns as places people want to escape (Doran, 2024). The characters show an awareness of Airdrie's reputation, with the character David Kilpatrick declaring that 'Everyone else thinks it's a dump; a horror show; an asylum' but that this ultimately 'serves to keep out the curious' (p.66). Paprika Jones emphasises the commitment and belief required in a local

music scene like Airdrie's, declaring: 'After all, it isn't easy being Iggy Pop in a small town in the west of Scotland' (p.251). According to her, everyone in the local scene 'was so originally weird as to prevent most of them from servicing any fixed notion of possibility' (p.253), thus highlighting that the artistic output in Airdrie was unique to its environment. For the band Memorial Device, the location of Airdrie is intrinsic to their sound. This is first highlighted in Ross's opening chapter, in which he also describes them as sounding like a 'black hole' (p.2), suggesting the town has a gravitational pull which cannot be escaped. This is a sentiment expressed elsewhere in the novel, with David stating that 'Hardly anyone ever leaves Airdrie' (p.66). Even so, Ross stresses that everyone believed Memorial Device 'would go the whole way' and 'vindicate Airdrie, valorise Coatbridge, memorialise Greengairs' (p.2). This indicates the belief that they would cement a place for these small towns in the wider cultural history of postpunk in Britain. At one point in the band's career, this appears to be a possibility when they are offered a record deal in London (p.132). However, the character Monica then details seeing the band live in Bellshill, describing their sound as a 'terrific gridlocked noise that sounded like a complete standstill even as it never stopped moving'. She then declares: 'They're going nowhere [...] and I [feel] relieved' (p.140). She later writes to Richard about the experience, saying: '[...] they've lost direction. The music just sits there and vibrates. It's amazing. It's like the soundtrack to my life' (p.140). Fisher describes the artistic impossibility of working-class achievement, arguing that artists either stay where they are and remain nothing or move up and become something only by erasing their origins (Fisher, 2006, as cited by Cano, 2023). However, applying this to the trajectory of Memorial Device is ineffective, as remaining in Airdrie does not render them as 'nothing' to its inhabitants. Monica's narrative confirms their music as contingent on the town of Airdrie. Her encounter with their art is made meaningful precisely because she feels it to be a reflection of her own life there. This illustrates the imaginative power of postpunk's presence for those living on the fringes of cultural centres and how the artistic output transforms their relationship with the town.

In contrast, Alasdair Gray's *Lanark* presents the character of Duncan Thaw as a young artist who feels that the environment of working-class, industrial Glasgow inhibits any sense of possibility for creativity. Thaw chafes against the expectations of the culture around him and the limited opportunities afforded, and his artistic wishes are oppositional to his geographic and class positioning. Gray himself states that young artists in Glasgow nearly always became teachers or went into industrial occupations because it was not possible to make a living through art (Allen, 2014, p.207). Gregorová (2015, p.51) highlights Thaw's reluctance to participate as a form of social resistance, which particularly opposes the ways that institutions shape individuals. This tension is especially clear when he starts secondary school. He describes the initial excitement upon seeing the magic suggested by the science room, which is then dampened by the teacher because Thaw feels 'nothing *he* taught would bring an increase of power or freedom' (p.151). Even in the art classroom, being taught about the laws of perspective and 'how these laws had to be learned before true art became possible' leaves Thaw to ultimately reflect that he 'was in a world where he could not do well' (p.151). He is disinterested in the monotonous and rigid structure of the working-class experience, declaring life to be a 'succession of dull habits in which he did what was asked automatically, only resenting demands to show interest' (p.157). The typical lifestyle that Thaw fears for his future becomes the reality of his friend Coulter, who details his experience of industrial work to Thaw:

'You stop thinking. Life becomes a habit. You get up, dress, eat, go tae work, clock in, etcetera etcetera, automatically, and think about nothing but the pay packet on Friday and the booze-up last Saturday. Life's easy when you're a robot.' (p.216).

Thaw is aware that being an artist does not fit into this lifestyle and is not seen as a viable career in his industrial city, lamenting that '[people] think you can be an artist in your *spare* time, though nobody expects you to be a spare-time dustman, engineer, lawyer or brain surgeon' (p.211). Ultimately, this illustrates a society which is not set up for Thaw to function in because of his love of the arts, thus isolating him (Allen, 2014, p.214). In this society, any transformative possibility of art is restricted and limited to

Thaw as an individual and imagination is not facilitated by the culture around him.

Once Thaw establishes this disinterest in his society, the author states: 'His energy had withdrawn into imaginary worlds, and he had none to waste on reality' (p.157). As Miller (2005, p.26) argues, Thaw retreats into his intense fantasy life and imagination in order to 'preserve a sense of exemption from the demands of his culture'. The text describes 'The vivid part of his life [becoming] imaginary' (p.134) at a young age. In withdrawing to his imagination and letting it take precedence over his reality, Thaw ultimately alienates himself further from the society around him. Falconer (2012, p.185) states that the fictional worlds that Thaw looks to 'suffer from being disconnected to his actual world or anyone in it'. This further evidences how Thaw feels that he cannot establish an imaginative relationship with his city in reality. In exempting himself from societal obligations through the world of fantasy, the pursuit of art becomes superior to everything else. This is exemplified in an argument with Ruth when she suggests that he believes his painting is 'more important than anything else' and Thaw agrees, stating: 'What I'm doing just now is more important than anything else happening in this whole city' (p.237). This attitude becomes even more evident when he leaves art school without doing an exam in favour of finishing his mural for the church, as he tells the tutors:

'This exam is endangering an important painting. It would be blasphemy to waste my talent making frivolous decorations for a non-existent liner. But I see your difficulty. You must uphold the art school, while I am upholding art. The solution is simple. Don't award me this diploma, I promise not to feel offended. The diploma is useless, except to folk who want to be teachers.' (p.323)

This furthers his disconnection from his surrounding society, as he views the possibility of 'upholding art' as oppositional to the intentions of the art school as an institution. While Thaw initially relies on his imaginary world to escape the environment he feels oppressed by, his pursuit of art in this instance displays him fully opting out of these social obligations in reality. However, this single-mindedness does not cultivate the freedom and

possibilities that he seeks. Allen (2014, p.214) argues that Thaw is as trapped as his friends, with his rejection of anything that appears to him as a compromise for the life he wishes to lead, meaning he has nowhere left to go. His retreat into imagination and withdrawal from society ultimately results in a descent into madness and his eventual death. As O'Gallagher (2007, p.546) summarises: 'Thaw's madness resides [...] in his inability to recognise other people, a solitude with clear political implications throughout Gray's novel'.

Thaw's narrative arc contributes heavily to establishing the fantasy world of Unthank. This dystopian vision of Glasgow and how it relates to the social realism of Books One and Two serves to highlight the overall socio-political message of the text and reinforce the reality of late twentieth-century working-class Scotland (Allen, 2014, p.213). This is addressed in the text by Nastler, who behaves as the representation of Gray as the author. He states that Thaw's death allowed 'a chance to shift him into a wider social context' (p.493). Lanark's character is born out of this, with Nastler telling him: 'You are Thaw with the neurotic imagination trimmed off and built into the furniture of the world you occupy' (p.493). The experimental and interrelated narrative structure of the text means that the social realistic setting of Thaw's narrative should not be taken for granted as the 'reality' over the fantastical landscape of Unthank. O'Gallagher (2007, pp.528-539) highlights that Thaw's narrative, being framed by the events of Books Three and Four and his presence as the only named character mentioned throughout all parts of the novel, ultimately undermines the realism of his sections. O'Gallagher then goes on to suggest that this implies that Thaw's section is fantastical and that Lanark's world is closest to 'representing the real'. Falconer (2012, p.183) reinforces this idea, stating that realism becomes the fantastical genre in the context of speculative capitalism, as it 'provide[s] the illusion of material solidity and permanence that the actual world lacks'. This then further relates to Falconer's (2012, pp.172-173) assertion that Unthank is a representation of 'capitalism as Hell' inspired by Glasgow in the 1970s and its status as a 'victim of global capitalism and its consequences'.

Gray's fantasy world is presented as a place without sunlight that is becoming rapidly more derelict and experiencing a 'building boom' despite

having a shrinking population (p.398). Time is a commodity and a form of energy, the wealth of which is accessible to the 'owners' and 'manipulators' (p.410). These owners in the council are described as 'destroy[ing] every way of life which doesn't bring them profit and call[ing] it government' (p.410). Part of Lanark's narrative is concerned with a desire to return to a vision of Thaw's postwar Glasgow and 'the prosaic moral goods of light, daily employment and human love' (Falconer, 2012, p.189). This longing for connection with others contradicts Thaw's narrative but also connects the two. As Nastler tells Lanark: 'The Thaw narrative shows a man dying because he is bad at loving. It is enclosed by your narrative, which shows civilization collapsing for the same reason' (p.484). At the end of Lanark's narrative, when he attempts to advocate for Unthank in the face of the oppressive political system, he is told by Lord Monboddo that a 'sad fact of human nature [is] that, in large numbers, we can only organise against each other'. Lanark refutes this claim, declaring there is no such thing as human nature and arguing that 'nations are not built instinctively by our bodies, like beehives; they are works of art, like ships, carpets and gardens. The possible shapes of them are endless' (p.550). This phrasing suggests the society of a nation as the artists with the ability to mould the reality around them. Thaw's narrative illustrates the constraints on imagination and how art is oppositional to the capitalistic focus on industry and economy in Glasgow, whereas Lanark's remark here demonstrates hope for creativity as a way to foster a better future for the city. Although Lanark ultimately fails in his appeal for Unthank, and Thaw fails to become a famous artist, Falconer (2012, p.191) argues that these failures do not invalidate the ambitions. Instead, it shows 'they are rarely achieved individually or in the space of a single life'. This contributes to Gregorová's (2015, p.49) description of Gray's work as 'envision[ing] a cooperative society that would balance the demands of the community and the desires of the individual'. In this respect, the representation of the artist in Thaw's narrative, when related to the wider context of the novel, highlights an imaginative landscape which suggests potentially transformative possibilities for Glasgow's society.

The creative relationship between the artist and their environment is approached differently in each text. For Keenan's characters in *This Is*

Memorial Device, the artistic community created through the postpunk culture of the eighties developed a sense of anticipation for the future in Airdrie. This text emphasises how the small-town setting is essential in successfully communicating the transformative power of postpunk in how it provides a sense of permission for residents to be involved in art, thus expanding the imaginative landscape. The artistic output described in the novel is a direct reflection of Airdrie and resonates with the imaginations of those in the community precisely because of this, and contributes to Keenan's overall aim of writing something which celebrates Airdrie instead of contributing to perceptions of it being a place to escape. On the other hand, Gray's text displays an artist who is isolated from his environment in Glasgow. Thaw struggles against the limitations of his predominantly working-class city, which does not allow space for his artistic sensibilities and therefore restricts his imaginative possibilities. This social isolation causes him to seek this sense of possibility in his own imagination. In doing so, Thaw establishes a relationship with art which is oppositional and superior to his environment, which only serves to further establish his alienation and lead to his descent into madness. However, considering his narrative arc in relation to the overall experimental structure of the novel places Thaw's failure in the wider political context of Gray's text, which criticises capitalism and seeks to imagine a more positive future for Glasgow. In this respect, both texts ultimately highlight how this imaginative relationship between artist and place has transformative qualities.

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An Environmental Approach to Offshore Wind Farm Planning: GIS Mapping of Carbon Storage, Economic Impacts, and Human Factors in the Western Irish Sea

Abigail Kennedy [1]

Climate change is widely acknowledged as an urgent global concern; because of this, renewable energy efforts have significantly increased worldwide. In the UK, this has predominantly focused on developing offshore wind farms. While essential for transitioning to greener energy, the rapid expansion of offshore wind farms has often outpaced the understanding of their environmental implications, particularly in regard to sedimentary blue carbon storage, a critical but under-researched component of marine ecosystems. The Western Irish Sea provides a valuable case study for assessing the interactions between sedimentary carbon storage, fisheries, and offshore wind farm development. This study uses GIS mapping to analyse environmental, economic, and human factors influencing site suitability for offshore wind farm construction and Marine Protected Area (MPA) designation. Key variables analysed include; sedimentary characteristics like organic carbon stock, dry bulk density, and sediment type; economic valuations of sedimentary carbon; and anthropogenic pressures such as fishing intensity, indicated by Nephrops norvegicus density. Shipping lanes and ferry traffic were also mapped to highlight potential conflicts with maritime activities. A thorough comparison of these maps identified recommended areas for MPA designation, preserving

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carbon-rich sediments, alongside three optimal sites for offshore wind farm development, ranked based on environmental, economic, and human factors. This approach highlights the importance of incorporating sedimentary carbon and other environmental factors early in renewable energy planning to minimise ecological impacts, enhance sustainability, and maximise economic profit. The findings provide an expandable framework for balancing renewable energy development with marine conservation, which could be used for offshore wind farm planning in other shelf sea environments.

Introduction

Whilst greenhouse gas emissions and climate change are now recognised as critical issues, they were not widely acknowledged until the 1980s. The 1992 Rio Earth Summit led to the establishment of the UNFCCC to stabilise atmospheric greenhouse gas concentrations at safe levels (COP28 UAE, 2023). However, despite considerable efforts, a lack of commitment from some nations and slower-than-expected progress suggest that achieving this goal is becoming increasingly unrealistic.

Although the human population remains heavily reliant on fossil fuels, the visible impacts of climate change and efforts to reduce greenhouse gas emissions have accelerated initiatives to protect carbon storage areas, such as sedimentary carbon stores. These efforts have also highlighted the need for renewable energy sources. Offshore wind energy, in particular, is seen as one of the most reliable options (Susini et al., 2022). The UK, a global leader in offshore wind, accounts for over 40% of Europe's offshore wind capacity, generating at least 17% of its electricity from this source (The Crown Estate, 2023). This is expected to increase as the UK and Northern Ireland work towards their clean energy targets, including Northern Ireland's goal of generating 1 GW of offshore wind energy by 2030 (Department for the Economy, 2023).

Offshore wind farms have been widely implemented across the UK since 2000 (The Crown Estate, 2019), but the significance of sedimentary

carbon storage was not yet fully understood. The term "blue carbon" was only coined in 2009 (Heinatz and Scheffold, 2023), nine years after the UK's first offshore wind farm was constructed, with sedimentary carbon stores only now beginning to be mapped.

The Western Irish Sea, a shallow shelf sea with strong and consistent winds, is an ideal location for offshore wind farm development (Gallagher et al., 2016). Despite remaining undeveloped, it is highly likely to see an increase in offshore wind farms in the coming years. However, it is also a significant area for carbon storage and a critical fishing ground for Nephrops norvegicus, commonly known as Dublin Bay prawns (Hill, Brown and Fernand, 1996). The Western Irish Sea, like much of the continental shelf, is already under considerable pressure from human activities, including fishing, oil and gas extraction, aquaculture, and MPAs. The introduction of offshore wind farms would add to competition for space, potentially leading to conflict. The current absence of offshore wind farms provides a unique opportunity to strategically plan their placement, considering blue carbon storage and anthropogenic pressures.

The term "blue carbon" refers to carbon stored in coastal and oceanic ecosystems, with substantial amounts sequestered in seabed sediments, particularly in shelf seas. Sedimentary carbon storage is heavily influenced by the biological carbon pump (BCP), which moves organic carbon from the ocean's surface to the seabed, where it is sequestered and remineralised as part of the carbon cycle. The BCP, essential in decreasing atmospheric CO_2, operates through three mechanisms: the gravitational pump (sinking planktonic organic carbon, or "marine snow"), the mixing pump (transport of neutrally buoyant organic carbon by water currents), and diurnal vertical migration (DVM), where zooplankton and fish transfer organic carbon to deeper waters (Le Moigne, 2019). This process has sequestered carbon for thousands of years, with seabed sediments storing more than double the amount of carbon found in terrestrial soils (Atwood et al., 2020). The ocean also acts as a buffer, mitigating carbon release—until recent years (Atwood et al., 2020).

Over 80% of global carbon is stored in the ocean, with more than half in marine sediments, approximately twice the amount stored in terrestrial soils (IUCN, 2017; Atwood et al., 2020). Shelf seas contribute significantly to marine primary production, making them crucial carbon sinks. The Western Irish Sea, located between the Atlantic Ocean and the North Sea, hosts extensive fine sediment capable of sequestering large amounts of carbon. This mud patch is also the preferred habitat for Nephrops, supporting a fishery that has been vital to the Northern Irish economy for generations (Hill et al., 1996).

Since the Industrial Revolution, the ocean has absorbed at least 40% of anthropogenic CO_2 emissions, with marine sediments serving as the largest carbon store (Epstein and Roberts, 2022). However, as their importance has come to light, so too has their vulnerability. The primary cause of carbon release from sediments, beyond natural processes like tidal mixing, is human activity (Luisetti et al., 2019). A predicted decline in the ocean's capacity to absorb atmospheric CO_2 due to climate change may further increase emissions (Epstein and Roberts, 2022), potentially turning a vital carbon sink into a source.

The Western Irish Sea's Nephrops fishery is sustained by a seasonal gyre that retains larvae and accumulates organic matter within the benthic mud patch, facilitating carbon sequestration (Macreadie et al., 2019). However, bottom trawling in these areas damages carbon stores, while wind farm construction disturbs seabed sediments, potentially reintroducing stored carbon into the water column (Heinatz and Scheffold, 2023). Despite this, operational wind farms may enhance carbon sequestration by fostering biofouling communities that filter organic matter and deposit carbon into sediments (Mavraki et al., 2022). Turbine structures also slow currents, increasing sediment deposition and stabilising carbon stores (Benkort et al., 2024).

To minimise disruptions to fisheries and carbon stores, a comprehensive mapping system is needed. Current offshore wind mapping primarily considers construction feasibility, with environmental and economic impacts often overlooked (Loughney et al., 2021). By identifying

areas with low Nephrops density and minimal sedimentary carbon storage, wind farms can be placed in locations that minimise both environmental and economic disruption.

This project aims to develop an integrated ArcGIS Pro mapping system incorporating biological, biogeochemical, and human factors affecting carbon storage to guide offshore wind farm and MPA placement in the Western Irish Sea. Additionally, an economic valuation of sedimentary carbon storage will highlight areas where wind farm development would have minimal financial impact. These maps will facilitate an informed assessment of optimal offshore wind farm locations, balancing environmental protection with economic considerations.

Materials and Methods

A dataset containing environmental and sedimentary data of the Western Irish Sea, provided by the Agri-Food and Biosciences Institute (AFBI), was used to inform a series of GIS maps and calculate the economic value of carbon at each site. The dataset covered 38 stations within the Western Irish Sea which were sampled during a 2022 cruise aboard the R.V. *Corystes* by AFBI. The original dataset was condensed down into the following columns for analysis in GIS: Nephrops density, dry bulk density, 5 cm carbon stock composite values, sediment grain size, economic value of carbon and depth.

Nephrops density was used as a proxy to identify areas under intense fishing pressure. Nephrops is an intensively fished species within the Western Irish Sea, therefore areas with high Nephrops density are usually correlated with high fishing pressure (Hill, Brown, and Fernand, 1996).

The 5 cm carbon stock composite was calculated by multiplying the organic carbon content by the dry bulk density, and then by depth. This method provided the most accurate representation of sedimentary carbon content by adjusting for variations in dry bulk density. While the dataset also included total carbon, organic carbon was chosen for the analysis because it is a more accurate indicator of carbon storage and ecosystem health (Geraldi et al., 2019). The 5 cm carbon stock composite values were used to assess

carbon storage. With the dry bulk density and sediment grain size values used to assess the carbon sequestration potential of the sediments across the sites following the assumption that areas with smaller sediment grain size and a lower dry bulk density usually have greater carbon sequestration and therefore a higher carbon sequestration potential (Alonso et al., 2021).

Using the 5 cm carbon stock composite values the economic value of sedimentary carbon was calculated. The equation used for the calculation is as follows:

$$\text{Economic Value of Sedimentary Carbon (GBP/km}^2\text{)} = (\text{Carbon Stock Composite (g/m}^2\text{)} \times 3.66) \times 76$$

Where 3.66 converts the stock carbon to the stock CO_2 equivalent and £76 is the UK Government's 2024 social cost of carbon, in alignment with the 2030 net-zero initiative (UK Government, 2023). The economic value of stored carbon in pounds sterling per square kilometre allowed for the identification of areas with higher potential economic loss due to the release of sedimentary carbon.

Water depth data provided valuable insight into the underwater geography of the Western Irish Sea, helping to identify areas shallow enough to accommodate the construction and decommissioning process of a non-floating offshore wind farm.

The above datasets were then imported into GIS and a separate layer created for each of the variables. Each variable was then assigned a yellow to red colour gradient with lighter yellow shades corresponding to lower values and darker red shades indicating higher values. This visual representation allowed for easy identification and comparison of areas best suited to offshore wind farm development. Additional GIS layers were then integrated from publicly available datasets. These included layers for shipping lanes and Marine Protected Areas (MPAs). The inclusion of these layers provided further context when evaluating potential wind farm development sites.

The final GIS map, composed of all of the layers, was analysed to identify the most suitable site for offshore wind farm development. The assessment considered environmental factors such as sediment characteristics, carbon stock, and fishing intensity, as well as economic considerations related to carbon storage. The best to worst locations for potential offshore wind farm development were highlighted, with green representing the most suitable location, yellow the second most suitable and red the least suitable. Areas recommended for MPA protection were also highlighted in purple.

Results

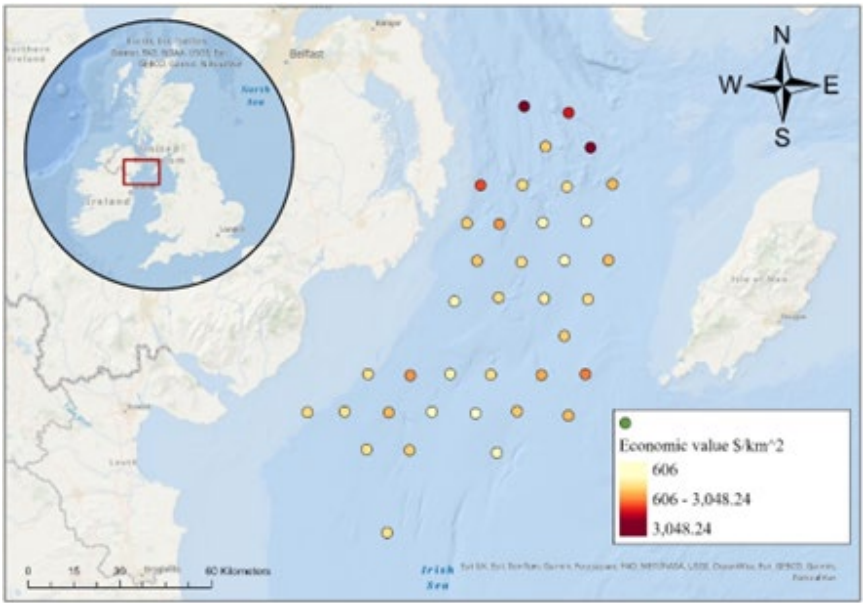


Figure 1 | Spatial Distribution of Sedimentary Carbon Economic Value (£/km²) Across 38 Sampling Stations in the Western Irish Sea. Sites with higher economic value are represented by darker shades of red, while lower values are depicted in lighter shades of yellow. This visual representation highlights areas of higher potential economic loss due to the release of stored carbon.

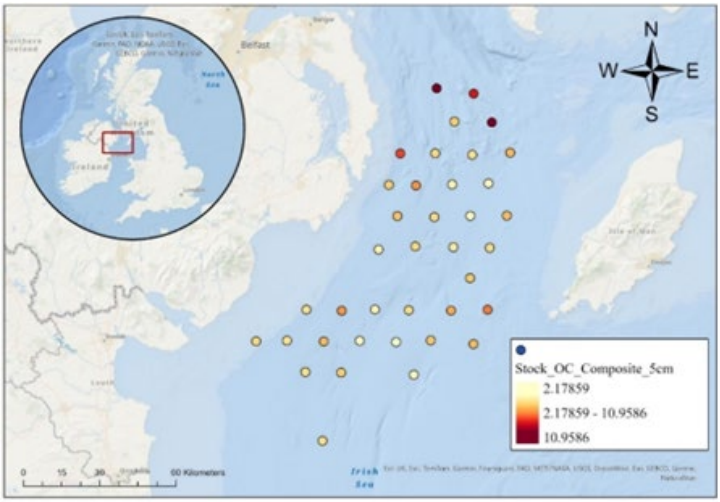


Figure 2 | Spatial Distribution of Organic Carbon Stock (g/m²) at 5 cm Depth Across 38 Sampling Stations in the Western Irish Sea. Sites with higher organic carbon stock are represented by darker shades of red, while lower values are depicted in lighter shades of yellow. This visual representation highlights areas with higher levels of stored sedimentary carbon.

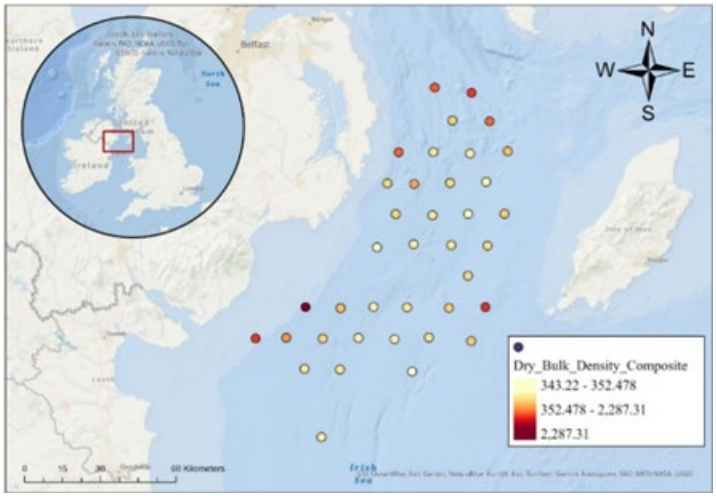


Figure 3 | Spatial Distribution of Composite Dry Bulk Density (kg/m³) Across 38 Sampling Stations in the Western Irish Sea. Sites with higher dry bulk density values are represented by darker shades of red, while lower values are depicted in lighter shades of yellow. This visual representation highlights areas with a higher mass of sediment per unit volume.

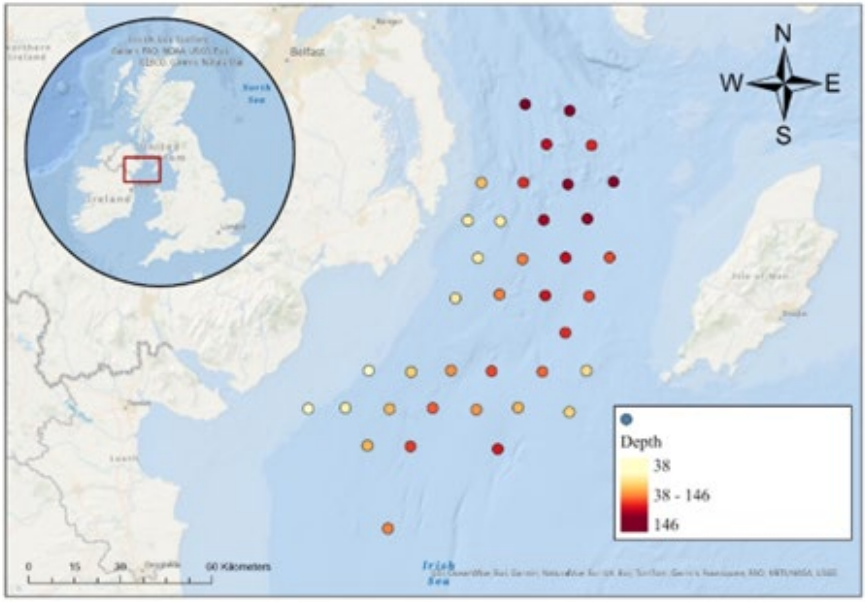


Figure 4 | Spatial Distribution of Seabed Depth (m) Across 38 Sampling Stations in the Western Irish Sea. Deeper areas are represented by darker shades of red, while shallower areas are depicted in lighter shades of yellow. This visual representation provides insight into the underwater geography and highlights shallower areas.

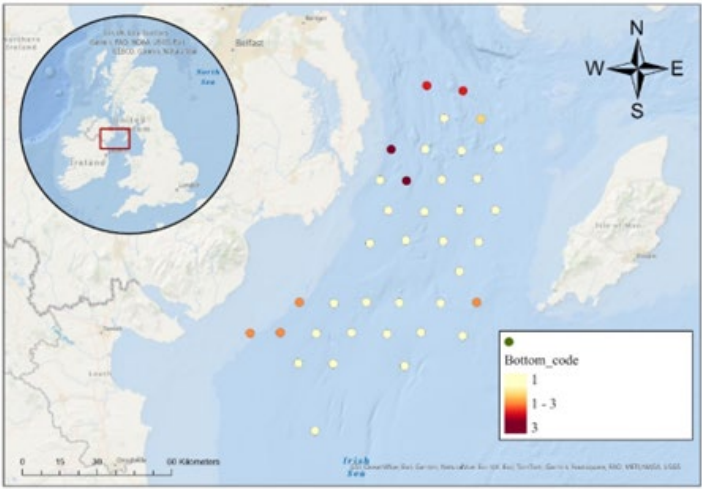
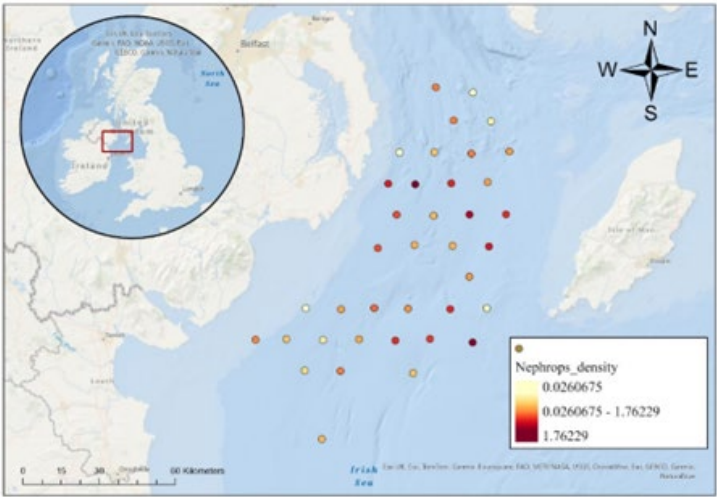


Figure 5 | Spatial Distribution of Sediment Types Across 38 Sampling Stations in the Western Irish Sea. Where 1 represents mud, 2 represents mud and shell, 2.5 represents sandy mud and shells with tube worms at the surface, and 3 represents sand. Sites with higher bottom code values are represented by darker shades of red, while lower values are depicted in lighter shades of yellow. This visual representation highlights the variation in sediment types.



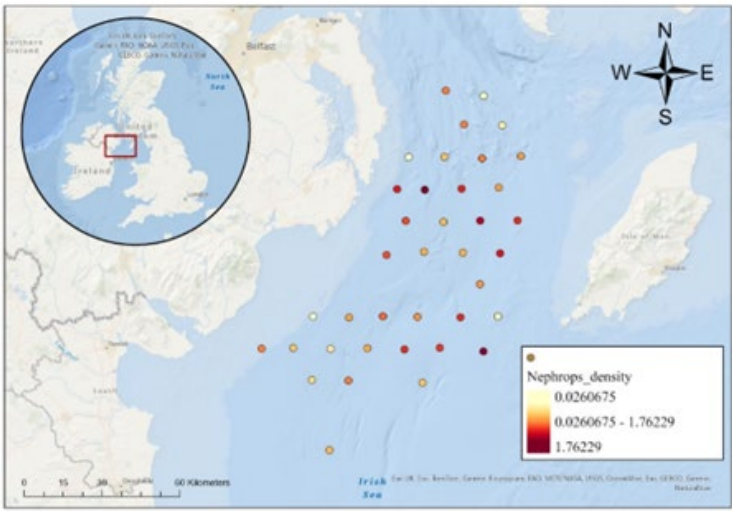


Figure 6 | Spatial Distribution of Nephrops Density (burrows/m²) Across 38 Sampling Stations in the Western Irish Sea. Sites with higher density values are represented by darker shades of red, while lower values are depicted in lighter shades of yellow. This visual representation highlights areas of higher Nephrops density, which serves as an indicator of fishing pressure.

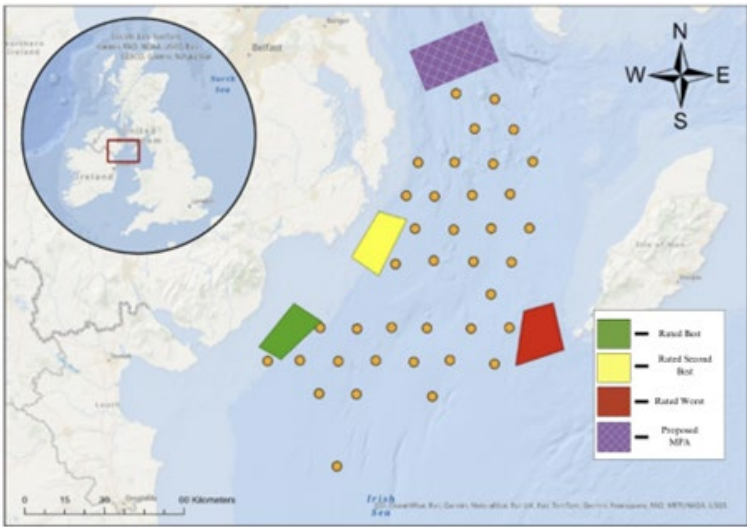


Figure 7 | Recommended Areas for Offshore Wind Farms and MPA's in the Western Irish Sea. This visual representation highlights areas recommended for offshore wind farm development and MPA from both an environmental and economic perspective.

Figure 8 | Passenger vessel density and ferry ports in the Western Irish Sea. Passenger vessel density, with darker shades of red indicating areas of higher density and lighter shades of yellow representing lower density. Ferry ports are also highlighted. This visualisation identifies areas of intensive shipping activity, informing where to place offshore wind farms to avoid major disruption.

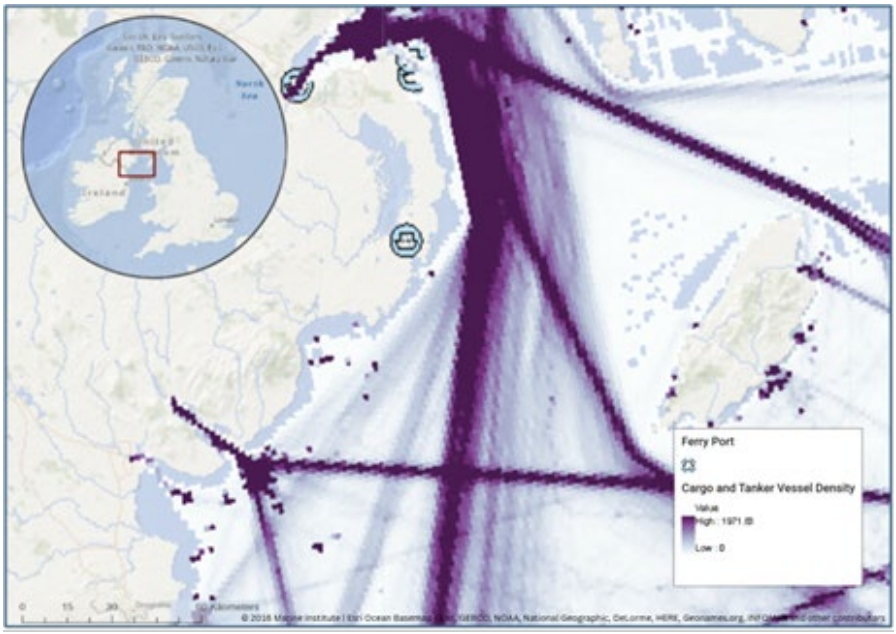


Figure 9 | Cargo and tanker vessel density and ferry ports in the Western Irish Sea. Cargo and tanker vessel density, with darker shades of purple indicating areas of higher density and lighter shades of blue representing lower density. Ferry ports are also highlighted. This visualisation identifies areas of intensive shipping activity, informing where to place offshore wind farms to avoid major disruption.

Discussion

Both the protection of sedimentary carbon and the rapid development of offshore wind farms play a vital role in combating climate change and achieving the UK government's Net Zero by 2030 target. The Western Irish Sea currently lacks significant offshore wind farm development but hosts substantial sedimentary carbon stores, intensive fisheries, and ideal conditions for renewable energy. This makes it an important case study to demonstrate the benefits of a comprehensive mapping system in offshore wind farm planning. This study focuses on three key factors influencing carbon storage in shelf seas: sedimentary carbon

storage, fishery displacement, and economic impact, with findings applicable to similar environments worldwide.

Mapping the top 5 cm of sedimentary organic carbon across 38 sites (Figure 2) highlighted areas with particularly high carbon stocks. These findings informed recommendations for avoiding offshore wind farm development in these locations to prevent the release of sequestered carbon during construction and decommissioning. The results also identified areas suitable for blue carbon marine protected areas, with the northernmost sites leading into the North Channel emerging as key locations where restrictions on destructive fishing practices and wind farm development would best preserve carbon storage.

A correlation between high sedimentary carbon storage (Figure 2), high dry bulk density (Figure 3), and high bottom code values (Figure 5) was observed in the northern sites. The relationship between high dry bulk density and greater carbon sequestration has been linked to decreased permeability, porosity, and ventilation (Alemu et al., 2022; Cacho et al., 2021). However, this pattern is unusual and may be influenced by the soupy nature of the sediment in this region. This relationship was not as strong in the sites surrounding the area ranked best for offshore wind farm development (Figure 7), which exhibited low carbon stock values (Figure 2) and high dry bulk density (Figure 3). By strategically placing an offshore wind farm in this area, minimal sequestered carbon would be released during construction, and the presence of turbine structures could enhance local carbon sequestration, effectively turning the area into a carbon sink (Heinatz and Scheffold, 2023).

Nephrops density was used as an indicator of fishing pressure, with higher densities assumed to correspond to greater fishing activity (Hill et al., 1996). Mapping Nephrops density (Figure 6) allowed identification of areas where offshore wind farm development should be avoided to minimise fishing displacement. By prioritising locations with lower Nephrops densities, disruption to fisheries can be reduced, limiting pushback from local fishing communities while protecting undisturbed sedimentary carbon stores.

Fisheries displacement caused by offshore wind farms in heavily fished areas could push destructive practices, such as dredging and trawling, into previously undisturbed regions. If these areas are disturbed, they would likely release large quantities of stored carbon and experience biodiversity loss (Black et al., 2022; Thrush and Dayton, 2002). While a general ban on these practices would be the most effective way to protect sedimentary carbon storage and biodiversity, enforcement remains unlikely. Instead, restricting harmful activities through MPAs and minimising fisheries displacement caused by wind farm development can help mitigate damage. Areas already impacted by intensive fishing practices have likely experienced significant sediment disturbance, meaning carbon release has already occurred (Lønborg et al., 2024). The seabed ecosystems in these areas are also likely to be dominated by opportunistic, fast-recovering species such as Nephrops, which outcompete slower-recovering species (MacDonald et al., 1996). Avoiding areas of high fishing pressure when selecting offshore wind farm locations also mitigates the economic impact of closing fishing grounds.

Understanding the economic implications of offshore wind farm development is critical in today's climate. By mapping the economic value of sedimentary carbon (Figure 1), areas with the greatest potential economic losses can be identified and avoided. Converting carbon values into economic worth allows for a more tangible assessment of the financial consequences of disturbing high-carbon areas. This approach provides a metric for further analysis and comparison in offshore wind farm planning to minimise economic losses.

Environmentally sustainable decisions often yield economic benefits. Avoiding high fishing pressure areas reduces disruptions caused by fishery closures, while selecting sites with low sedimentary carbon stores (Figure 2) minimises carbon loss during construction and reduces associated economic losses. Examining seabed sediment characteristics, such as dry bulk density (Figure 3) and sediment grain size (Figure 5), ensures wind farm locations are chosen to maximise carbon sequestration, benefiting both economic and environmental interests.

Human factors must also be considered to prevent disruptions to existing marine activities and avoid public resistance. The Western Irish Sea experiences high shipping activity, with ferry links between Britain and Ireland seeing thousands of vessels annually (The Irish Sea Network, 2022). Mapping major shipping routes and harbours (Figures 8 and 9) helps ensure offshore wind farms are positioned to avoid key transit areas. A comparison of Figures 7 and 8 demonstrates that the selected sites minimise interference with major shipping lanes.

Another constraint on offshore wind farm placement is seabed depth. Fixed-bottom offshore wind farms remain the most common design (Díaz and Guedes Soares, 2020) and require shallow waters for foundation placement. The depth map (Figure 4) highlights that most suitable sites are located along the mainland coast.

The comprehensive assessment of environmental, economic, and human factors resulted in the identification and ranking of three potential offshore wind farm locations (Figure 7). The red location was initially considered viable due to its low fishing pressure, high dry bulk density, and proximity to the Isle of Man. However, depth mapping (Figure 4) revealed a significant drop-off in seabed depth, complicating construction. Additionally, the site intersects a major shipping route (Figures 8 and 9) and contains high levels of stored carbon and economic value (Figures 1 and 2), meaning wind farm construction would result in substantial carbon release and financial loss. While Nephrops density in the immediate area is low (Figure 6), surrounding waters experience high fishing pressure, which could lead to increased fisheries displacement.

The yellow location emerged as the second-best option. It is shallow (Figure 4), near land, avoids major shipping routes (Figures 8 and 9), and has relatively low stored carbon and economic value (Figures 1 and 2). However, it is located near areas with high fishing pressure (Figure 6), meaning construction could cause significant fisheries displacement. Despite this, the site remains a strong candidate for development.

The green location was ranked as the most suitable for offshore wind farm development. It is close to land, in shallow waters (Figure 4), and does

not interfere with major shipping routes (Figures 8 and 9). It also has low fishing pressure (Figure 6) and low values for stored sedimentary carbon and economic impact (Figures 1 and 2). Based on a thorough assessment, this site would cause the least disruption from an environmental and economic perspective.

While this project provides a strong framework for offshore wind farm placement, it is based on a single year of data. Expanding data collection over multiple years would provide a more accurate assessment of sedimentary carbon stocks and allow for tracking of environmental changes such as marine heatwaves. Future studies should also examine sedimentary carbon beyond 5 cm depth, as a deeper assessment would provide a more complete understanding of sequestration potential. Additionally, sampling in the North Channel could determine its significance as a carbon sequestration site. Further investigation is also needed to explore the relationship between high dry bulk density, larger sediment grain size, and high carbon sequestration values (Figures 2, 3, and 5), as this contradicts typical hypotheses and may be linked to local sediment characteristics.

With a more extensive dataset, assessments could be conducted before, during, and after wind farm construction to better understand how offshore wind farms impact sedimentary carbon storage. However, this project does not account for the long-term effects of climate change on oceanic systems. Research suggests that global oceanic current systems may weaken or disappear entirely due to climate change (Hays, 2017), yet limited research exists on smaller systems such as the Western Irish Sea's seasonal gyre. If this gyre weakens, it could significantly impact the Nephrops fishery, which relies on stable nutrient circulation. Additionally, ocean warming and acidification may lead to shifts in species distributions, with many marine organisms exceeding their tolerance thresholds (Doney et al., 2012).

Future offshore wind farm planning must integrate predictive climate models to anticipate these changes. By adopting a holistic approach that considers long-term environmental and economic factors, offshore wind farms can be developed in ways that minimise disruption while maximising climate benefits. This study highlights the importance of a comprehensive

mapping system in balancing renewable energy expansion with the protection of sedimentary carbon stores and fisheries, offering a valuable framework for sustainable offshore wind farm development.

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Complications of Jejunal Feeding Tubes in Children: A Retrospective Analysis

Serena Shoker [1]

Jejunal feeding is a type of enteral feeding, whereby a tube is inserted into the jejunum distal to the ligament of Trietz. It can be a successful method of feeding for patients with neurological impairments or comorbidities, or those who have contraindications for oral or gastric feeding. There are several types of jejunal access including nasal, gastric, or via jejunostomy. Whilst jejunal feeding is often a successful method of enteral feeding, complications can arise, including obstruction, buried bumper, or improper tube placement leading to further issues like perforation. The aims of the study were to identify major complications associated with jejunal feeding tubes and to compare these between different tube types in paediatric patients across the North of Scotland. Data was collected for 120 patients across three health boards: Grampian, Highland, and Tayside, between 2014-2024. Demographic data, underlying diagnosis, jejunal feeding information including surgical techniques and overall complications were acquired per patient from local databases. A total of 465 jejunal tube changes were recorded, and of these 258 (55.5%) led to complications. The most common indication for jejunal feeding was gastro-oesophageal reflux disorder *(38.3%) and the mean number of tubes per patient utilised was 3.88. The most common medical complication was tube displacement (45.7%) followed by tube obstruction (16.7%), whilst leak (34.5%) was the most common complication for surgical jejunostomies. Regarding patient outcomes, 34 (28.3%) patients died, with 50% of these deaths being due to intestinal failure. Overall, the complication rates of jejunal feeding are*

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significant in this study, however further research and more data is necessary to create more reliable results.

1. Introduction

Jejunal feeding is a method of enteral feeding where a tube bypasses the stomach and is placed distally to the ligament of Trietz (Broekaert et al., 2019). It can be used as a route for short or long-term enteral nutrition in patients with contraindications to oral or gastric feeding, including neurological impairments or for those with inadequate oral intake and malnutrition status (McCann et al., 2019). Neurological impairments can result in dysphagia, aspiration of gastric contents, malnutrition, and severe reflux, among other complications, which means these patients have definite need for enteral feeding and often specifically jejunal feeding (Romano et al., 2017). Other indications for jejunal feeding include gastrointestinal (GI) dysmotility, gastro-oesophageal reflux disorder (GORD), gastric obstruction due to inoperable tumours or recurrent peptic ulcers, and in some cases due to duodenal strictures (D'Cruz and Cascella, 2024). Jejunal feeding is overall an established safe and effective way to provide sufficient nutrition for a patient, however a multidisciplinary approach must be taken alongside appropriate education for caregivers to ensure the maximum benefit with minimal complications for patients (Broekaert et al., 2019).

1.1 Jejunal Feeding Tubes

There are several routes of access to the jejunum which can be used: nasal (NJ) (Figure 1), percutaneous endoscopic gastro-jejunostomy (PEG-J), gastrojejunostomy (GJ) (Figure 2), direct jejunostomy (Figure 3), and Roux-en-Y jejunostomy. It has been recommended that an upper gastrointestinal (GI) endoscopy is carried out prior to jejunal tube placement to ensure there will be minimal mechanical complications post-operatively (Broekaert et al., 2019). There are different methods for placing jejunostomies which include open surgery, laparoscopic, needle catheter technique or percutaneous technique via endoscopy with a minimally invasive technique being preferred for most patients (D'Cruz and Cascella, 2024). Several devices are available to use through these access points into the jejunum. The appropriate

access point and device are chosen on an individual patient basis with consideration to anatomy, pathology, symptoms and patient preference (Broekaert et al., 2019).

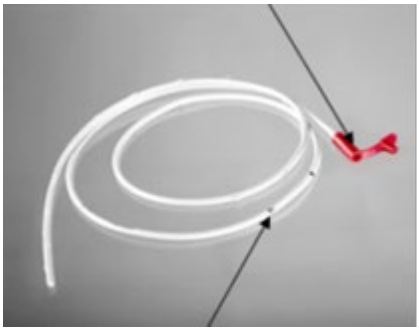

Figure 1: Naso-jejunal (NJ) tube. The image shows an NJ tube which is inserted through the nose into the jejunum for jejunal feeding (NHS choices, 2022).

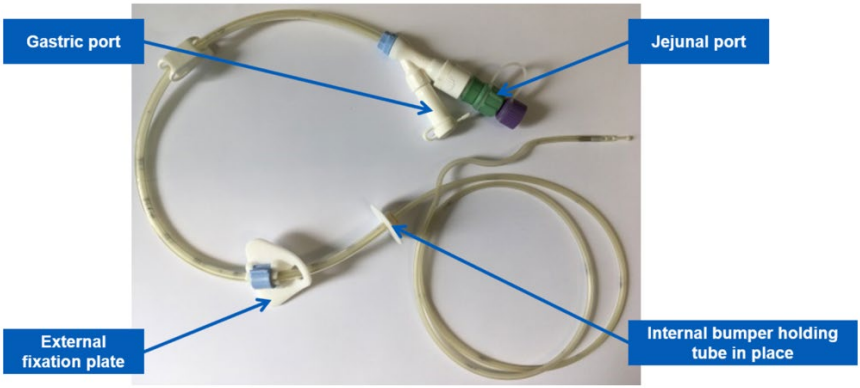

Figure 2: Percutaneous endoscopic gastro-jejunostomy (PEG-J) tube. The image represents a PEG-J feeding tube which is a commonly used device for jejunal feeding (PEG-J feeding tube, NHS choices, 2024).

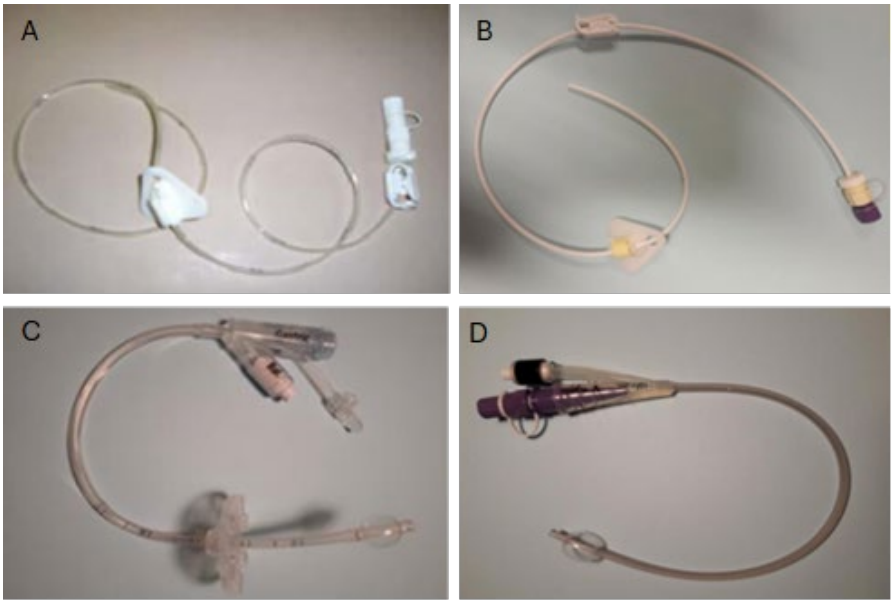

Figure 3: Freka direct jejunal tube (A), Vygon direct jejunal tube (B), Vygon Mic G tube used for direct jejunal feeding (C), balloon (Foley) catheter used for direct jejunal feeding (D). The images represent different feeding tubes which can be used for jejunal feeding including direct jejunal tubes, button jejunal device and catheter which can be inserted via the jejunostomy technique (Direct jejunostomy tube, NHS choices, 2022).

Jejunal feeding is a well-established technique for nutrition and drug delivery, however, it poses several risks and complications including bowel ischaemia or obstruction, bowel perforation, intussusception, buried PEG bumper, leaks, or over-granulation (Campwala et al., 2015; McCann et al., 2019). Complications specific to NJ tubes may include epistaxis or sinusitis, whilst PEG-J or GJ tubes have a high rate of displacement or incorrect tube placement which then lead to further and more serious complications as mentioned (McCann et al., 2019). Studies have shown that NJ tubes may have lower rates of major or life-threatening complications when compared with the use of GJ tubes, and complication rates are similar to those caused by surgical jejunostomies (McGrath et al., 2024).

There are also several contraindications which must be considered. Absolute contraindications for jejunal tube feeding include paralytic or mechanical ileus, intestinal obstruction or perforation and necrotising enterocolitis (Broekaert et al., 2019). Relative contraindications include peritonitis, ascites, GI bleeding, dysmotility or immunocompromised patients (Broekaert et al., 2019; D'Cruz and Cascella, 2024).

1.2 Aims and Objectives

The aim of this study is to identify major complications associated with jejunal feeding across three health boards in Scotland and to compare different methods of jejunal feeding devices in relation to these complications. This study aims to determine which jejunal feeding device provides the lowest and highest risk of complications with respect to the requirement for jejunal feeding. Further, this research involves comparison of secondary outcomes including such as length of hospital stay, device duration, and how often replacement is required. Overall, the findings of this project will add to current research surrounding jejunal feeding devices with the aim of improving patient outcomes and reducing complications.

2. Methods

2.1 Data Collection

Paediatric patient data was collected and analysed from three health boards across Scotland: Grampian, Highland and Tayside across a ten-year period, from 2014 to 2024. A total of 120 patients were analysed for the study.

Patient demographic data including age and sex were collated. The underlying diagnosis, indication for jejunal feeding, type of jejunal feeding device used, mode of insertion or surgical technique, and adverse effects experienced with each device were collected. The type of tube, size, and brand of tube were gathered. The primary outcomes for this study are the complications associated with jejunal feeding devices. These include tube obstruction, displacement, perforation, intussusception, volvulus, over granulation, buried PEG bumper, tube leakage, and death. The time from

insertion until the start of complications was noted where possible. The data was compiled through use of local patient databases including TrakCare and SCI store documents for Grampian and Highland, and use of Clinical Portal and ICE for Tayside. All data has been anonymised for the purpose of this study.

2.2 Inclusion and Exclusion Criteria

Paediatric patients were selected based on a few criteria to ensure consistency with results and analysis. Patients undergoing procedures within the 10-year period between 2014 and 2024 were selected. Those with jejunal feeding tubes including NJ, PEG-J, GJ or jejunal tubes inserted by direct jejunostomy or Roux-en-Y jejunostomy were included whilst patients with solely gastric feeding methods including nasogastric (NG) tubes or gastrostomy were excluded.

2.3 Statistical Analysis

Microsoft Excel software was used to carry out statistical analysis on the data compiled within the study. The mean, median, and standard deviation were calculated for the patient age range. A Pearson chi-square test was used to determine the significance between differing feeding tube types per complication that occurred. A p value of <0.05 was used to determine whether results were of statistical significance or not.

3. Results

120 paediatric patients undergoing jejunal feeding between 2014 and 2024 were included in this study. Data was collected from three health boards across Scotland: Grampian, Highland and Tayside with a total number of patients per health board of 78, 18 and 24 respectively.

Use of 465 jejunal feeding tubes were recorded which included complications and non-complications leading to tube change. Per health board, 249 (53.5%) tubes were recorded for Grampian, 66 (14.2%) for Highland and 150 (32.3%) for Tayside.

3.1 Patient Demographics

The mean patient age was 9.03 ± 5.97 years (age range 1-26 years). Mean age of patients in Grampian was 8.37 ± 6.03 (1-26 years), in Highland was 10.27 ± 4.84 years (3-21 years), and in Tayside was 10.21 ± 6.44 years (2-22 years). The median age was 8 years overall. The average age for a jejunal device to be inserted was 6.17 years (4.95 years, Grampian; 6.61 years, Highland; 8.00 years, Tayside) (Table 1).

Table 1: Demographic data summarised overall for all patients and per health board including total number of patients, gender, age range, mean age and standard deviation (SD) and average age of patients when a jejunal tube was inserted.

	Overall	**Grampian**	**Highland**	**Tayside**
Patients (N)	120	78	18	24
Male (N)	64	40	11	13
Female (N)	56	38	7	11
Age range (years)	1-26	1-26	3-21	2-22
Mean age ± SD	9.03 ± 5.97	8.37 ± 6.03	10.27 ± 4.85	10.21 ± 6.44
Median age	8	8	10	10.5
Average age at tube insertion (years)	6.17	4.95	6.61	8.00

3.1.1 Patient Deaths

The total number of patients who died from all-cause mortality was 34 (28.3%) with most occurring in Grampian (27; 34.6%); while 2 (11.1%) occurred in Highland and 4 (16.7%) in Tayside (Table 2).

Table 2: The total number of deaths counted across 120 patients as an overall number and percentage presented overall and per health board.

	Total Deaths – N (%)
Overall	34 (28.3)
Grampian	27 (34.6)
Highland	2 (11.1)
Tayside	4 (16.7)

The causes of death were identified with 50% of these patients dying due to intestinal failure (Table 3). 31 patients of these patients died whilst still receiving jejunal feeding whilst 3 of these patients died after transitioning to gastric feeding from jejunal feeding.

Table 3: Causes of death presented as a number and percentage for all patients overall and per health board. "Other" causes includes underlying diagnosis and multi-organ failure.

	Cause of Death – N (%)			
	Intestinal failure	Sepsis	Cardiac arrest	Other
Overall	17 (50)	2 (5.9)	2 (5.9)	13 (38.2)
Grampian	16 (59.3)	1 (3.7)	2 (7.4)	8 (29.6)
Highland	0 (0)	0 (0)	0 (0)	2 (100)
Tayside	1 (25)	1 (25)	0 (0)	2 (50)

3.2 Underlying Diagnosis and Indication for Feeding

The underlying diagnoses and indication for jejunal feeding were counted overall and per health board. Cerebral palsy (CP) was a diagnosis of interest and therefore counted separately to other neurological syndromes which included conditions such as Rett's syndrome or West syndrome. The most common diagnoses were CP (22.5%), other neurological syndromes (22.5%) and other congenital or genetic abnormalities (23.3%). CP was further categorised using the GMFCS ranging in severity from one to five

with five being the highest severity. Furthermore, it was noted whether these patients with CP had epilepsy or did not have epilepsy. Other diagnoses included failure to thrive (11.7%), GI abnormality (12.5%) or other (7.5%) for those conditions that did not fit into any category.

The most common indication for jejunal feeding across all patients was GORD (38.3%). 28.3% of patients had GI dysmotility whilst 21.7% of patients required feeding due to a mix of GI dysmotility and GORD, where it was difficult to categories these patients into one sole indication for feeding. The least common indications were gastroparesis (4.2%) and unsafe swallow (7.5%) due to underlying diagnoses (Table 4). Across Grampian and Tayside health boards, GORD was the most common indication for feeding (34.6% and 50% respectively), whilst in Highland there was an equal number of patients who had GORD (38.9%) or GI dysmotility (38.9%) (Table 4).

Table 4: Indication for jejunal feeding for patients overall and per health board reported as total number of patients and percentage.

	Indication for Jejunal Feeding - N (%)				
	GI dysmotility	GORD	GI dysmotility + GORD	Gastroparesis	Unsafe swallow
Overall	34 (28.3)	46 (38.3)	26 (21.7)	5 (4.2)	9 (7.5)
Grampian	23 (29.3)	27 (34.6)	18 (23.1)	3 (3.8)	7 (9.0)
Highland	7 (38.9)	7 (38.9)	3 (16.7)	1 (5.6)	0 (0.0)
Tayside	4 (16.7)	12 (50.0)	5 (20.8)	1 (4.2)	2 (8.3)

3.3 Jejunal Feeding Tubes

The total number of feeding tubes was 465 for 120 patients across the 10-year period studied. This was divided into the numbers for each feeding tube; NJ, PEG-J, GJ and jejunal tubes. Jejunal tubes were then

further divided into the surgical procedure; Roux en Y or Direct. The most utilised feeding tube was an NJ tube overall (33.8%), similarly in Grampian at 39.8%. However, PEG-J tubes were most utilised in Highland (50%) and Tayside (35.3%) (Table 5).

The mean number of tubes used per patient was 3.88 overall in comparison to Grampian (3.19) and Highland (3.67) which had similar means for tubes per patient. However, Tayside had a mean number of 6.25 tubes per patient which was almost double the number of tubes used per patient overall, in Grampian and in Highland (Table 5).

Table 5: The total number of jejunal feeding tubes counted across 2014-2024 for 120 patients. The mean number of tubes per patient alongside total numbers for each specific feeding tube are displayed alongside the percentage per total tubes as an overall number and per individual health board.

	Mean tubes per patient (N)	**Total Number of Jejunal Feeding Tubes – N (%)**					
		NJ	PEG-J	GJ	Jejunal (Direct)	Jejunal (Roux en Y)	Total
Overall	3.88	157 (33.8)	149 (32.0)	109 (23.4)	17 (3.7)	33 (7.1)	465
Grampian	3.19	99 (39.8)	63 (25.3)	57 (22.9)	15 (6.0)	15 (6.0)	249
Highland	3.67	16 (24.4)	33 (50.0)	11 (16.7)	0 (0)	6 (9.1)	66
Tayside	6.25	42 (28.0)	53 (35.3)	41 (27.3)	2 (1.3)	12 (8.0)	150

The mean feeding tube duration in situ was found and the standard deviation was also calculated. Overall, the mean duration of all tubes in situ was 6.03 ± 5.81 months. Results were separated into individual tube types with a duration of 3.28 ± 5.62 months for NJ tubes, PEG-J; 6.31 ± 5.66

months, GJ; 7.63 ± 5.62 months and jejunal devices; 10.34 ± 5.81 months (Table 6).

Table 6: The mean duration of feeding tubes in situ measured in months as an overall total for all feeding tubes and across each individual feeding tube type as a total and per health board.

	Mean duration of tube in situ (months ± SD)				
	Overall	NJ	PEG-J	GJ	Jejunal
Total	6.03 ± 5.81	3.28 ± 5.62	6.31 ± 5.66	7.63 ± 5.62	10.34 ± 5.81
Grampian	6.61 ± 6.82	3.31 ± 6.45	7.76 ± 6.42	9.03 ± 6.85	10.46 ± 6.82
Highland	4.29 ± 3.99	2.81± 4.01	4.59 ± 4.10	5.91 ± 4.23	3.33 ± 1.99
Tayside	5.83 ± 4.37	3.41 ± 3.88	5.62 ± 4.38	6.1 ± 4.41	13.07 ± 4.64

The overall mean hospital stay and the standard deviation was calculated in days at 1.46 ± 3.78 days with median stay of 1 day (Table 7). The longest mean hospital duration was 2.74 ± 7.34 days found in Highland with a median duration of 3 days (Table 7).

Table 7: The mean and median hospital stay in days was calculated overall and per health board.

	Overall	Grampian	Highland	Tayside
Mean (days ± SD)	1.46 ± 3.78	1.00 ± 2.24	2.74 ± 7.34	1.65 ± 3.56
Median (days)	1	1	3	1

3.4 Tube Insertions

The insertion for NJ, PEG-J and GJ tubes were performed by either endoscopic, radiological, or floating techniques, the latter being exclusive to NJ tubes. The majority of tubes were inserted by a radiological technique (57.8%), most commonly NJ and GJ tubes, typically under fluoroscopic guidance, whilst overall 40.2% of tubes were inserted via endoscopy (Table 8). Eight NJ tubes were inserted via a floating technique. Radiological technique was most commonly used for Grampian (63.9%) and Tayside (61.8%) whilst in Highland, endoscopy was the most commonly used technique (73.3%) (Table 8).

Table 8: The mode of insertion for each tube type was counted and presented as a total number and percentage overall and per health board.

Health Board	Tube Type	Mode of insertion – N (%)		
		Endoscopic	Radiological	Floating
Overall	NJ	15 (9.0)	134 (55.8)	8 (100)
	PEG-J	138 (82.6)	11 (4.6)	0 (0)
	GJ	14 (8.4)	95 (39.6)	0 (0)
	Total	167 (40.2)	240 (57.8)	8 (1.9)
Grampian	NJ	7 (9.7)	85 (60.7)	7 (100)
	PEG-J	62 (86.1)	1 (0.7)	0 (0)
	GJ	3 (4.2)	54 (38.6)	0 (0)
	Total	72 (32.9)	140 (63.9)	7 (3.2)
Highland	NJ	8 (18.2)	8 (50)	0 (0)
	PEG-J	27 (61.4)	6 (37.5)	0 (0)
	GJ	9 (20.5)	2 (12.5)	0 (0)
	Total	44 (73.3)	16 (26.7)	0 (0)
Tayside	NJ	0 (0)	41 (48.8)	1 (100)
	PEG-J	49 (96.1)	4 (4.8)	0 (0)
	GJ	2 (3.9)	39 (46.4)	0 (0)
	Total	51 (37.5)	84 (61.8)	1 (0.7)

Two surgical techniques were employed for insertion of a jejunostomy, either via direct or Roux en Y procedures. Overall, 36% of jejunal tubes were inserted via a direct procedure versus 64% inserted using

Roux en Y (Table 9). The Roux en Y procedure was used more often than the direct procedure across all three health boards.

Table 9: The primary insertion of jejunal tubes counted across a direct versus Roux en Y surgical technique overall and per health board, presented as the total number and percentage.

Surgical Technique	Primary Insertion (N) (%)			
	Overall	Grampian	Highland	Tayside
Direct	9 (36)	8 (44)	0 (0)	1 (20)
Roux en Y	16 (64)	10 (56)	2 (100)	4 (80)
Total	25 (100)	18 (100)	2 (100	5 (100)

3.5 Complications of Feeding Tubes

A total of 258 complications and 207 non-complications occurred overall. Non-complications are other indications for tube change. This category includes planned tube replacements, removals, ongoing use of feeding tubes, and when patients have moved health services therefore follow up of their current situation was not possible (Table 10). The most common complication to occur overall was displacement (45.7%) and secondly tube obstruction (16.7%). This was similar across Grampian and Highland, although the second most common complication in Tayside was leaks (20.7%) (Table 10). Planned tube replacement was indication for tube change classed as a non-complication and was the most common to occur, with 128 (61.8%) tubes replaced overall (Grampian: 59 (55.1%), Highland: 20 (54.1%), Tayside: 49 (77.8%)) (Table 10).

Table 10: Complication occurrence of feeding tubes and non-complication occurrence. Non-complications are other indications for tube change including planned tube replacement. Data presented as a total number and percentage of overall incidence and per health board.

Complication Occurrence – N (%)				
Complication	Overall	Grampian	Highland	Tayside
Tube obstruction	43 (16.7)	26 (18.3)	6 (20.7)	11 (12.6)
Displacement	118 (45.7)	61 (43.0)	13 (44.8)	44 (50.5)
Perforation	7 (2.7)	1 (0.7)	1 (3.4)	5 (5.7)
Intussusception	2 (0.7)	0 (0)	0 (0)	2 (2.3)
Volvulus	1 (0.4)	0 (0)	1 (3.4)	0 (0)
Buried PEG bumper	10 (3.9)	6 (4.2)	1 (3.4)	3 (3.4)
Over-granulation	3 (1.7)	3 (2.1)	0 (0)	0 (0)
Infection	1 (0.4)	1 (0.7)	0 (0)	0 (0)
Leak	40 (15.5)	17 (12.0)	5 (17.2)	18 (20.7)
Vomiting	2 (0.7)	2 (1.4)	0 (0)	0 (0)
Death	31 (12.0)	25 (17.6)	2 (6.9)	4 (4.6)
Total	258	142	29	87
Non-Complication Occurrence – N (%)				
Non-complication	Overall	Grampian	Highland	Tayside
Planned Replacement	128 (61.8)	59 (55.1)	20 (54.1)	49 (77.8)
Ongoing	40 (19.3)	22 (20.6)	10 (27.0)	8 (12.7)
Planned removal	35 (16.9)	24 (22.4)	7 (18.9)	4 (6.4)
Moved services	4 (1.9)	2 (1.8)	0 (0)	2 (3.2)
Total	207	107	37	63

The overall complication occurrence per tube type was recorded, with displacement being a statistically significant complication ($p = 0.028$). It was the most common complication to occur (Table 11).

Table 11: The occurrence of complication and non-complication indications for tube change per tube type. Data presented as raw numbers and percentages. Where 0 complications occurred, the percentage occurrence was 0%. Significance of differences determined by Pearson chi-squared test. $p<0.05$ is deemed statistically significant.

Overall Complication Occurrence per Tube Type – N (%)					
	Tube Type				*p* value
Complication	**NJ**	**PEG-J**	**GJ**	**Jejunal**	
Tube obstruction	16 (10.2)	16 (10.8)	6 (5.5)	5 (10)	0.507
Displacement	49 (31.2)	41 (27.5)	22 (20.2)	6 (12)	0.028
Perforation	1 (0.6)	2 (1.3)	4 (3.7)	0	0.186
Intussusception	0	1 (0.7)	1 (0.9)	0	0.660
Volvulus	0	0	0	1 (2)	0.048
Buried PEG bumper	0	7 (4.7)	3 (2.8)	0	0.040
Over-granulation	0	1 (0.7)	0	2 (4)	0.020
Infection	0	0	0	1 (2)	0.060
Leak	7 (4.5)	8 (5.3)	15 (13.8)	10 (20)	0.002
Vomiting	1 (0.6)	0	1 (0.9)	0	0.635
Death	7 (4.5)	11 (7.4)	9 (8.3)	4 (8)	0.740
Non-Complication	**NJ**	**PEG-J**	**GJ**	**Jejunal**	
Planned replacement	52 (33.1)	32 (21.5)	34 (31.2)	10 (20)	0.408
Ongoing	6 (3.8)	16 (10.7)	8 (7.3)	10 (20)	0.002
Planned removal	18 (11.5)	12 (8.1)	5 (4.6)	0	0.071
Moved services	0	2 (1.3)	1 (0.9)	1 (2)	0.410

The overall complication occurrence was counted by year from 2014-2024 with the highest number of complications recorded in 2023 at 43 and the lowest recorded in 2024 at 3 (Table 12).

Table 12: The overall complication occurrence presented as a total number and percentage per year for the study period 2014-2024. Where 0 complications occurred, the percentage occurrence was 0%.

Overall Complication Occurrence by Year – N (%)												
Complication	Year											
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Tube obstruction	2 (16.7)	1 (25)	6 (40)	2 (10.5)	1 (5.3)	6 (16.7)	7 (21.2)	6 (17.6)	4 (10.0)	8 (18.6)	0
Displacement	1 (8.3)	3 (75)	5 (33.3)	10 (52.6)	16 (84.2)	15 (41.7)	14 (42.4)	19 (55.9)	18 (45.0)	15 (34.9)	2 (66.7)
Perforation	1 (8.3)	0	0	0	0	0	0	1 (2.9)	3 (7.5)	2 (4.7)	0
Intussusception	0	0	0	0	0	0	0	0	1 (2.5)	1 (2.3)	0
Volvulus	0	0	0	0	0	0	1 (3.0)	0	0	0	0
Buried PEG bumper	0	0	2 (13.3)	0	0	1 (2.8)	0	4 (11.8)	2 (5.0)	1 (2.3)	0
Over-granulation	1 (8.3)	0	0	0	0	0	0	1 (2.9)	0	0	1 (33.3)
Infection	0	0	0	0	0	1 (2.8)	0	0	0	0	0
Leak	3 (25)	0	2 (13.3)	5 (26.3)	0	8 (22.2)	6 (18.2)	2 (5.9)	9 (22.5)	5 (11.6)	0
Vomiting	0	0	0	0	0	0	0	0	0	2 (4.7)	0
Death	4 (33.3)	0	0	2 (10.5)	2 (10.5)	5 (13.9)	5 (15.2)	1 (2.9)	3 (7.5)	9 (20.9)	0
Total	12	4	15	19	19	36	33	34	40	43	3

3.5.1 Complications by Surgical Method

A total of 29 complications occurred in patients with surgical jejunostomies and 21 non-complications, meaning another indication for tube change was required. The most common complication for jejunal tubes overall was leak with a total of 10 (34.5%) instances where this occurred (Table 13). More jejunal tubes inserted by Roux en Y had a leak (47.1%) compared to by the direct method (16.7%). Jejunal tubes inserted by direct surgical method showed more cases of displacement (41.7%) as opposed to Roux en Y (5.9%). Similar rates of tube obstruction were caused by Roux en Y (17.6%) compared with the direct method (16.7%). More patients who had a Roux en Y procedure died (17.6%) when measured against the direct procedure (8.3%) (Table 13).

Table 13: The overall list of complications and non-complications (other indications for tube changes) that occurred with surgical jejunal tubes. Data is presented as a total number and percentage per surgical method; Roux en Y or Direct.

	Surgical Method	
	Roux en Y	Direct
Complications		
Tube obstruction	3 (17.6)	2 (16.7)
Displacement	1 (5.9)	5 (41.7)
Perforation	0 (0)	0 (0)
Intussusception	0 (0)	0 (0)
Volvulus	1 (5.9)	0 (0)
Buried PEG bumper	0 (0)	0 (0)
Over-granulation	1 (5.9)	1 (8.3)
Infection	0 (0)	1 (8.3)
Leak	8 (47.1)	2 (16.7)
Vomiting	0 (0)	0 (0)
Death	3 (17.6)	1 (8.3)
Total	17	12
Non-Complications		
Planned Replacement	9 (60.0)	1 (16.7)
Ongoing	5 (33.3)	5 (83.3)
Planned removal	0 (0)	0 (0)
Moved services	1 (6.7)	0 (0)
Total	15	6

3.5.2 Complication Frequency per 1000 days Exposure

The overall complication frequency per 1000 days exposure was calculated for each jejunal feeding tube and the most common complication occurrence was displacement of NJ tubes at 6.7 displacements per 1000 days exposure.

The complication frequency per 1000 days exposure for each tube type was calculated for each tube type per health board (Table 14). The tube which faced the most complications was the NJ tube overall (11.1) and for each health board; Grampian,11.3, Highland, 24.6 and Tayside, 10.0. The NJ tube in Highland had a larger number of complications as opposed to Grampian and Tayside, with over double the number of complications occurring per 1000 days exposure to the NJ tube (Table 14). No direct jejunostomies being put in place in Highland, therefore the rate of complications was zero for direct jejunal tubes (Table 9). Overall, both jejunal tubes inserted via Roux en Y or direct procedures had the lowest rates of complications per 1000 days exposure compared with the three other tube types (Table 14).

Table 14: The total complication occurrence per 1000 days exposure to a jejunal feeding device presented per tube type.

	Complication occurrence per 1000 days exposure to jejunal tube (complication/1000 days)				
	NJ	PEG-J	GJ	Roux en Y	Direct
Overall	11.1	5.9	4.5	3.3	3.8
Grampian	11.3	4.6	3.8	3.3	3.7
Highland	24.6	9.2	13.3	11.1	0.0
Tayside	10.0	6.7	5.6	2.1	4.4

3.6 Patient Outcomes

The overall patient outcomes were determined for each patient at the end of the 10-year period studied. 48 (40%) patients had a planned removal of their jejunal feeding tube either transitioning to gastric or oral feeding methods. 31 (25.8%) patients died whilst still receiving jejunal feeding. The other three patient deaths which were counted occurred after their jejunal feeding was ceased and they had transitioned to gastric feeding (Table 3), therefore they are categorised here as a planned removal of jejunal tube

(Table 15). Four (3.3%) patients had moved services, with two patients transitioning to adult services and two patients had moved health boards and so follow up was not possible. Finally, 37 (30.8%) patients have ongoing jejunal feeding regimens in place (Table 15).

Table 15: Patient outcomes at the end of the study period were identified and categorised into 4 outcomes; death, planned removal, moved services or ongoing jejunal feeding. Data is presented as total number and percentage.

Patient Outcomes	N (%)
Death	31 (25.8)
Planned removal	48 (40.0)
Moved services	4 (3.3)
Ongoing	37 (30.8)

4. Discussion

Overall, the complications of jejunal feeding tubes have been analysed throughout the course of this study across three Scottish health boards. Medical and surgical complications were assessed alongside looking at tube types and underlying diagnosis.

Jejunal feeding has been described as high stress method of feeding when compared to gastric methods due to direct passage of nutrients into the small bowel. This is due to the lack of initial digestion that would occur in the stomach prior to entry to the small bowel with the aid of gastric hormones, therefore potentially resulting in greater susceptibility to complications (Garrett-Cox et al., 2003).

4.1 Implications of Research

In this study cohort, 45% of patients had some form of neurological impairment. These patients accounted for 57.4% of the complications that occurred and of the 34 patient deaths, 50% of these were due to intestinal

failure. This therefore shows that jejunal feeding in those with neurological impairment may have a substantial and detrimental effect. Approximately 50% of patients with severe neurological disabilities receive less than 81% of their required nutritional intake and so a more permanent solution for feeding may be beneficial to establish (Quitadamo et al., 2016). This would need to be with consideration of the underlying diagnosis, as patients with neurological impairment are at high risk for malnutrition due to their indication for feeding, typically GI dysmotility or GORD, however they are also higher risk for complications with jejunal feeding (Quitadamo et al., 2016). Although, the European Society for Paediatric Gastroenterology, Hepatology and Nutrition (ESPGHAN) guidelines recommend that despite complications these patients face with both medical and surgical jejunal feeding methods, there is clinical benefit to feeding children with neurological impairment in this way as opposed to attempting oral feeds (Romano et al. 2017).

A significant proportion of complications (55.5%) were documented across all patients who had feeding tube replacements with therefore 44.5% of patients experiencing no complications. Results were similar across each health board in terms of complication type and relatively proportional for the number of patients for both Grampian and Highland (1.82 and 1.61 complications per patient) however more complications occurred per patient for Tayside (3.6). The complication rate per year appeared to increase over time with the highest complication rates in 2023 (16.7%), however this is likely due to better documentation in more recent years, thereby resulting in misleading increasing rates of complications per year.

NJ tubes had the highest rate of complications with an overall of 11.1 complications occurring per 1000 days exposure, and per health board (Table 14). These are typically utilised as a short-term enteral feeding solution and often have issues with displacement and obstruction which were the commonest complications found in this study. It was shown that NJ tube displacement was the highest specific complication overall with 6.7 displacements occurring per 1000 days exposure. Due to this complication, tube replacements frequently occur, increasing radiation exposure and time spent in hospital. Similar results were seen for PEG-J and GJ tubes with

displacement being the most common complication, which calls to question whether conversion to surgical jejunostomy would be more beneficial for long-term patient outcomes as these procedures are associated with fewer complications, reduced hospital visits, and lower radiation exposure (Broekaert et al., 2019). However, this should be in done with consideration to the patients underlying diagnosis and their wishes to ensure the decision around their feeding is in their best interest.

In this study, the most common surgical complication was jejunostomy leak as opposed to displacement or obstruction which were the most common complications found in the other tubes. This has been shown across studies where leakage is a typical complication that occurs regardless of the use of differing surgical techniques (van Braak et al., 2023). Other common complications are usually over-granulation of the jejunostomy site or mild infection; however, these can be managed in the community without hospitalisation. Overall, surgical jejunostomies are a safe and effective long-term strategy for feeding, although both medical and surgical interventions pose their own risks. A larger study is needed to adequately compare both surgical methods to determine the most appropriate intervention with minimal complications.

The type of tube in place showed differing rates of complications (Table 11) and further analysis into whether there is a link between the type of tube, the duration in situ or a combination of multiple factors should be assessed. In one study, it was found that the use of PEG-J tubes resulted in many complications compared to use of a gastric PEG alone with rates of obstruction and tube displacement being significantly higher in PEG-J than the use of PEG tubes (Ao et al., 2015). However, one limitation was that many patients had undergone major GI surgery prior to jejunal feeding and so presented with more complex anatomy which may have resulted in these complication rates (Ao et al., 2015). High complication rates were found in this study for tube displacement (27.5%) and obstruction (10.8%) for PEG-J tubes in patients who had not undergone surgery. Therefore, it is difficult to ascertain whether these complications occur due to the jejunal tube type or underlying diagnosis and previous procedures. It is likely that a combination of several factors influences the incidence of complications that occur

although further analysis into diagnosis, particularly the impact of neurological impairment, would be useful. As mentioned, jejunal feeding may also cause more physiological stress, when compared to gastric feeding which is another avenue that could be explored, directly comparing complications and outcomes of patients who are fed via jejunal or gastric methods.

Overall, the data in this study has provided useful insight into the complications of jejunal feeding with further areas for development and more in-depth research, however the study recognises some weaknesses that should be addressed.

4.2 Limitations

Several limitations have been identified within the study despite collating substantial data regarding patient complications of jejunal feeding. The overall documentation surrounding patient jejunal feeding was limited, particularly prior to 2014. Information regarding diagnosis, tube size and brand used were not always well detailed, leading to some absent data.

Many feeding tubes are replaced in radiology departments and this data is not reported on the databases that were searched for this study; therefore, it is likely that many planned tube replacements; primarily NJ and GJ tubes, have been missed and the complication rate would appear inflated in the results of this study. To obtain more complete results, it would be important to collate this data.

Also, jejunal tubes are often changed in community settings and so data regarding community-based tube changes were not recorded on hospital databases. This may have an impact on the results of duration of jejunal tubes in situ, leading to perhaps more frequent planned tube changes for which information was not gathered. This means that the mean tube duration recorded may not be entirely accurate without this additional data. Similarly, complications such as infection or over-granulation can be managed in the community and so incidence of these recorded on hospital databases were disproportionately low. It would therefore be beneficial for further studies to

include data from the community to gain a better understanding of the complications of jejunal feeding tubes.

Further research could look at underlying diagnoses. with particular interest to CP, to determine whether severity of diagnosis impacts complication rates and patient outcomes. It would also be interesting to consider the all-time radiation exposure per patient to determine if this has any impact on all-cause mortality.

4.3 Conclusion

Overall, it has been found that the rate of several complications of jejunal feeding is significant in this cohort and this provides useful insight into the specific tube types causing issues, complication rates in medical versus surgical methods, and recognition that underlying diagnosis has an influence on these complications. However, limited data have been identified due to a lack of documentation in some areas. These issues are to be addressed in future studies to obtain more reliable results. Additional research would be useful to advance the methods of jejunal feeding to improve practices and ultimately patient outcomes.

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The Arrival of Anglo-Saxons in Post-Roman Britain: The Traditional Model's Impact on Historical Narrative

Michael Hardman[1]

After the end of Roman rule, Anglo-Saxons began to arrive and settle in Britain. The traditional model envisaged a large number of invaders, who conquered the country, killing or driving out the Romano-British native population, with those who remained being enslaved. This paper examines critically the traditional model in the light of recent scholarship relating to archaeology, place-name studies, agricultural practices, economic and urban activity, and cemetery practices. It concludes that in fact there is no archaeological evidence of a large-scale invasion or violent supplanting of the native population, but rather that the evidence suggests relatively peaceful long-term immigration and settlement. The Romano-British and Anglo-Saxons co-existed, with a merger of cultures and the eventual evolution of what could be termed as the first English society.

"The Traditional Model"

There has long been debate about the course of events following the end of Roman rule in Britain. Victorian historians such as Stubbs (1870) and Freeman (1895), relying on the earliest accounts by Gildas and Bede, described the arrival of large numbers of Anglo-Saxon immigrants, who caused most of the Romano-British native population to either flee or be driven out to the west. The newcomers thus 'entered upon a land whose defenders had forsaken it' (Stubbs 1870, 1) and 'instead of either mixing with the [Romano-British] people, or else leaving them their own laws and

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part of their lands, they always either killed or made slaves of all the people that they could' (Freeman 1895, 28). The Anglo-Saxons therefore took over a largely deserted landscape, on which they imposed their culture, language, farming methods and general way of life (Myres 1986, 214).

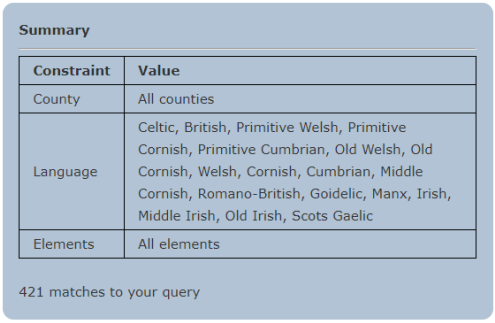
However, this narrative, which might be called "the traditional model", has become increasingly less tenable in view of recent scholarship relating to archaeology, place-name studies, agricultural practices, economic and urban activity, and cemetery practices. Far from fleeing or being killed or enslaved, it appears that the Romano-British continued to live and work in their ancestral homeland. The Anglo-Saxons who did arrive, who were by no means as numerous as the traditional model suggests, did not take over the countryside en masse, but instead settled alongside the native population.

The Number of Anglo-Saxons Immigrants

The number of Anglo-Saxon immigrants has been considered by Härke. After analysing both biological and archaeological data, he concludes there were no more than 100,000/200,000 arrivals, that is about 10% of the native population (Härke 2011, 8-9). Furthermore, immigration continued for more than a century. This is in stark contrast to the traditional model's narrative of a vast number of immigrants almost entirely replacing the Romano-British natives over a relatively short period. As Burmeister puts it, 'the image of a mass migration appears ill-suited to the portrayal of the process (Burmeister 2000, 553).

Place-name Evidence

At first sight, place-name evidence would seem to support the traditional model. A search on the HALOGEN website, based on data provided by the Institute for Name-Studies at the University of Nottingham, reveals only 421 modern English place-names with a "Celtic" element, compared with 12,507 with an "Old English" element (Figs. 1 and 2).



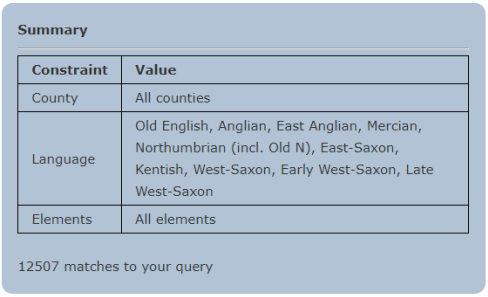
Summary

Constraint	Value
County	All counties
Language	Celtic, British, Primitive Welsh, Primitive Cornish, Primitive Cumbrian, Old Welsh, Old Cornish, Welsh, Cornish, Cumbrian, Middle Cornish, Romano-British, Goidelic, Manx, Irish, Middle Irish, Old Irish, Scots Gaelic
Elements	All elements

421 matches to your query

FIG. 1: "Celtic" place-names in England

https://halogen.le.ac.uk/results/results.php?county%5B%5D=all&lang%5B%5D=AGGCE&hword_list%5B%5D=all&placename=&placename_match_type=exact&data_set=kepn (Accessed 8/2/24)



Summary

Constraint	Value
County	All counties
Language	Old English, Anglian, East Anglian, Mercian, Northumbrian (incl. Old N), East-Saxon, Kentish, West-Saxon, Early West-Saxon, Late West-Saxon
Elements	All elements

12507 matches to your query

FIG. 2: "Old English" place-names in England

https://halogen.le.ac.uk/results/results.php?county%5B%5D=all&lang%5B%5D=AGGOE&hword_list%5B%5D=all&placename=&placename_match_type=exact&data_set=kepn (Accessed 8/2/24)

Numbers such as these led Victorian scholars to the conclusion that Anglo-Saxons almost completely replaced the Romano-British in most of what eventually became England. Freeman, for example, points out that '[in] Eastern and Midland counties, you will hardly find one Welsh name' (Freeman 1895, 16). Indeed, some modern scholars, for example Coates (2007) express much the same view.

To a similar effect, Gelling and Cole suggest that although further settlement and the creation of new names occurred during the whole Anglo-Saxon period, a considerable number of place-names derive from the fifth century (Gelling & Cole 2000, xix). Their implication is that the fifth century was very significant in the formation of English place-names, and that since the vast proportion of such names were Anglo-Saxon in origin, a similar proportion of the population must equally have had the same origin. If this is indeed the case, it would lend powerful support to the notion that by the end

of the fifth century, the overwhelming majority of the population was Anglo-Saxon, the Romano-British having been driven out or killed.

However, Hall has argued convincingly that at least until about 700 AD, place-names were markedly unstable, with two-thirds of names appearing in charters issued during the second half of the seventh century having now been lost (Hall 2012, Fig.7.1, p. 106). Such instability is demonstrated by the fact that Romano-British place names survive no more widely in Wales and Cornwall, where Anglo-Saxon influence was far less, than in eastern England (Higham & Ryan 2013, 99). Many place-names incorporated a personal name, and may well therefore have changed on more than one occasion during the fifth and sixth centuries as British names were replaced by Anglo-Saxon (Higham 1992, 203). Thereafter, names became progressively more stable, the reason for this probably being an increase in the use of written records. The preponderance of Anglo-Saxon place-names therefore suggests that Anglo-Saxon culture and language became gradually more dominant throughout the whole period, rather than taking over abruptly during the fifth century.

Indeed, further analysis of place-names lends additional support to the premise that the Romano-British and Anglo-Saxons co-existed for a considerable time, rather than the former being quickly supplanted by the latter. The Anglo-Saxon word for a native Romano-Briton, *wealh*, from which derives the modern "Wales" and "Welsh", has given rise to a number of English place-names, for example Walcott "cottages of the Welsh" and Walton "Welsh settlement". These names occur throughout the whole country (Fig. 3). It follows that Romano-British must have been living alongside the Anglo-Saxons for a considerable time, leading to their settlements being named accordingly by the Anglo-Saxons.

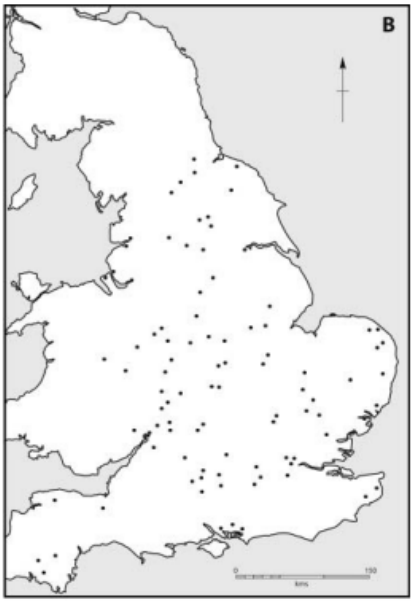


FIG. 3: Härke 2011, Fig. 2(B), p. 3

[Place names derived from *wealh- (*or *walh-*)]

Farms and Farming

As we have seen, the traditional model assumed that the land had been 'forsaken' by the Romano-British and consequently left unfarmed (Stubbs 1870, 1). However, if that had occurred, within about thirty years at most there would have been a reversion to woodland (Rackham 2000, 67; Harmer *et al* 2001). In fact, as Rippon *et al* (2015) have demonstrated, an analysis of the historic prevalence of tree pollen shows that there was generally no widespread regeneration of woodland after the end of Roman rule (see also the review by Higham 1992, 77-79, reaching a similar conclusion).

Indeed, recent findings, based on ecological and environmental archaeology, air photography and analysis of population trends have suggested that the land was not abandoned, but that many native field systems persisted and that the Romano-British continued to occupy the landscape. These conclusions have not been universally accepted, as discussed by Oosthuizen (2013, 51-55) and Rippon *et al* (2015, 3-7), but they

do seem to be in more in accordance with recent research. What seems to have occurred is that the Romano-British continued farming, but on a lesser scale. The end of Roman rule involved, among other things, the end of Roman taxes and the disappearance of an easy market for surplus goods. This resulted in 'not a major discontinuity as such, but essentially a partial reversion or retreat to a pre-Roman pattern of land use' (Hamerow 2002, 152). Farmers did not need to raise sufficient produce to pay taxes or sell elsewhere, but only needed to provide for themselves and their families, so it was not necessary for them to farm as large an area.

Romano-British farmers naturally concentrated their farming on the best land, thus leaving less productive land which could be taken over by Anglo-Saxon immigrants. As a result, many early Anglo-Saxon settlements are on somewhat marginal sites, such as Chalton Down, Mucking and West Stow (Higham 2004, 10). In all probability the Romano-British peasantry continued to pursue their time-honoured activities as best they could, subject to the societal changes that were happening around them (Higham 1992, 104).

Coinage and Economic Activity

The end of Roman rule also led to the cessation of coin minting. As a result, very few coins have been found dated later than 402 AD (Esmonde Cleary 2011, 18). This has led some archaeologists to surmise that there had been some form of catastrophic economic collapse (see the discussion in Gerrard 2013, 73-117). However, the sudden absence of new coinage does not necessarily mean that any change in economic activity was equally sudden. The findings are just as consistent with a gradual change which, in the absence of easy dating indications, is not revealed by the archaeology.

Indeed, there is evidence that coin use continued during the fifth century. For example, the Hoxne hoard, the largest hoard of late Roman artefacts so far discovered in Britain, contains eight coins minted as late as 407/8 AD. All of these, as well as many of the others, had been clipped, a practice of cutting away some of the coin's silver while leaving the central

image intact. In this way some silver could be extracted to provide bullion, while the coin could still be used as currency. These findings show that the coins in question were still in use after 407/8 AD, suggesting that some form of Romano-British authority and monetary system continued into the fifth century, and that there was no sudden collapse after the end of Roman rule (Higham & Ryan 2013, 50-51).

Hoxne is not an isolated example. Burnett describes a large number of hoards containing coins from the late fourth and early fifth centuries (Burnett 1984). As at Hoxne, the coins in many of these hoards had been clipped, suggesting continuing currency use. Nevertheless, as Johns points out, the most obvious reason why a hoard should be concealed in this way 'is that the owner feared that his or her money or other valuables might be seized or stolen' (Johns 1996, 6). The fact that the owners of these hoards felt it necessary to hide their wealth away and were never able to fulfil their presumed intention to return and retrieve it suggests that they, at least, considered that they were living in uncertain and troubled times: 'Periods of civil unrest will indeed increase the incidence of burial of hoards and also of failure to recover them' (Johns 1996, 6).

Other archaeological findings point to continuing economic activity and to the elite retaining their wealth, at least initially. In Lincoln, two buildings have been found which have been interpreted as late and post-Roman (fifth to sixth century) churches (Green 2008, 18-23). This suggests that the British elite were still in control of the city to such an extent that they were able to invest time and resources into the construction of churches, and presumably, other municipal establishments.

Further evidence of urban life continuing can be found at Wroxeter. At this location excavations have revealed that major rebuilding took place probably after 400 AD (Barker 1975; more fully Barker *et al* 1997). This involved 'a planned complex of timber-framed buildings', as Barker concludes:

> ‘This drastic reorganisation of the city-centre needed wealth, strong motivation, and a high degree of organisation. This is not the work of a peasant village, nor can it be attributed to incoming Irish or Saxon invaders…We must surely be looking at a complex of religious or public buildings, or the private demesne of a great man.’ (Barker 1975, 115)

This renaissance of the city centre, however, was short-lived. The complex of buildings was apparently deliberately dismantled, and the city centre abandoned in an orderly fashion in about 500 AD (Barker 1975, 116). Thereafter, Wroxeter gradually went into decline, although it never completely died but rather ‘progressively contracted’ (Henig 2011, 519-20).

It should be noted that Barker’s views have not been universally accepted. Halsall, for example, considers that it is difficult to see how Wroxeter continued as an urban centre ‘when its inhabitants remained archaeologically all but invisible.’ He suggests instead that the location ‘can very plausibly be understood as a high-status site belonging to a powerful local ruler established in the ruins of a Roman town.’ (Halsall 2007, 359). Higham (1992, 104; 2004, 2) comes to much the same view. That said, it should be borne in mind that, as Blair points out, the conditions at Wroxeter, consisting of ‘flattened and fragmented rubble rather than soil’ were highly exceptional, and it was only because of this that the features could be seen at all. Similar conditions existed at the Hadrian’s Wall fort at Birdoswald, where large timber buildings have been discovered, the later phase of which should be dated fifth or sixth century. Structures of this type may have been common, but in most contexts would not be visible archaeologically (Blair 2018, 38-9). There is evidence from a number of other towns of urban rebuilding and occupation in the fifth and sixth centuries (Higham 2004, 2; Henig 2011, 516). Especially when considering other locations explored, therefore, Barker’s argument is entirely feasible.

Evidence from other ‘private demesne[s]’ also suggests some continuation in Romano-British wealth and influence. A mosaic floor at the villa at Chedworth, for example, has been dated to after 424 AD. As Papworth points out, ‘[t]he accepted narrative for sub-Roman

Gloucestershire does not include the polite refurbishment of buildings and the laying of new mosaic floors.' However, that appears to be precisely what occurred here, the obvious conclusion being 'that a wealthy family continued to live there, in some style, well into the 5th century' (Papworth 2021). Papworth discusses further evidence for occupation of Chedworth by the elite during the fifth and sixth centuries. Mediterranean wine and olive oil were still reaching the villa during this period. Sherds of late Roman shelly ware, which was not produced before 360 AD, have been discovered. Nor does Chedworth stand alone in this respect; similar ware has been discovered at other villas in the area, and as Papworth points out, there is evidence of 5th to 6th century occupation from a number of other sites.

At other villas, too, there is evidence of occupation and building activity into the fifth and sixth centuries. At Denton, for example, significant rebuilding took place in about 370 AD, and a further phase of rebuilding in stone can be identified as taking place after this during the fifth century, which continued to be maintained in the sixth century (Smith 1964). At Great Casterton the villa was occupied well into the fifth century, and after it then burnt down, a new corn-drying oven was built, suggesting continued occupation (Corder 1961).

It should be noted, however, that these findings do not indicate that life continued unchanged. In some areas the mosaic floor at Chedworth had been built over or eroded, suggesting a more utilitarian use for these parts of the villa. Papworth suggests that perhaps the owners, 'under reduced circumstances', concentrated their more formal accommodation in a smaller area (Papworth 2021). The building of a corn-drying oven at Great Casterton may also indicate a more utilitarian use, since previously such ovens would be some distance from the villa itself.

Many villas were abandoned during the post-Roman period. Hamerow refers to a number of villas having 'produced evidence of what has conventionally been called "squatter occupation", although this is now generally regarded not as representing the re-use of abandoned sites, but rather the final phase of their occupation'. Some of the instances discussed above may be examples of this. These accommodations do not, however,

signify that their occupants were driven out of their homes, as the traditional model would suggest, but rather represent 'the continuing occupation of these sites by the same families, who nevertheless adopted very different building styles and lifestyles' (Hamerow 2012, 12-16).

The decline at Chedworth and Great Casterton thus mirrors to some extent that in towns such as Wroxeter and others, for example Silchester and Verulamium, although Biddle suggests that Verulamium and Wroxeter are better regarded as cases of settlement shift (Biddle 1976, 110). The evidence from all of these examples, however, does not suggest a sudden and rapid collapse after the end of Roman rule, but rather the initial maintaining of a comfortable lifestyle, which gradually came to an end during the fifth century. Although Higham suggests that '[t]here is just no alternative to the conclusion that urban life ceased in most places by the mid-fifth century' (Higham 2004, 5), the evidence considered above demonstrates that such cessation was a gradual process, and that some towns continued to be occupied for a time after then.

Cemetery Practices

The gradual changes discussed above in both urban and rural life have a parallel in the adoption of new cemetery practices. Cremation cemeteries, where the body is cremated, appear to have originated during the period 400-420 AD. Later, inhumation cemeteries, where the body is buried, became more common. Cremation cemeteries are more numerous towards the north and east, with inhumation towards the south and west (Fig. 4). That being said, it should be noted that in fact almost all early Anglo-Saxon cemeteries contain examples of both practices (Welch 2001, 149). The locations of the different types of cemeteries may reflect immigration from different parts of the continental North Sea coast (Hills 2017, 250), but for present purposes it suffices to note that both types demonstrate very different practices to those previously adopted by the Romano-British. Given the date at which cremation cemeteries first appeared, this suggests that there had been some Anglo-Saxon immigration before the end of Roman rule.

Therefore, rather than a sudden invasion after the departure of the Romans, we see a gradual Anglo-Saxon influx over a considerable period of time.

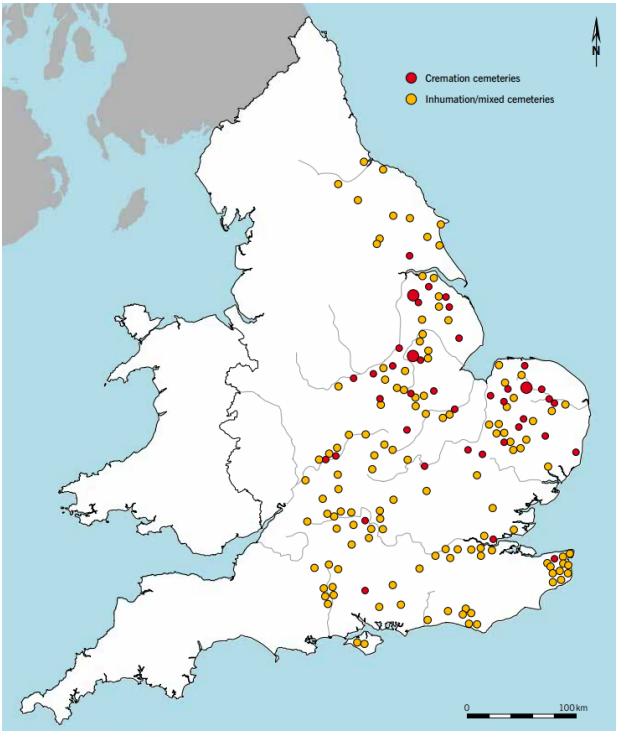


FIG. 4: 'Distribution of selected cremation, inhumation and mixed cemeteries in England, 5th-6th centuries AD.'

Hills 2017, p. 251, Fig. 8

The occurrence of both cremation and inhumation cemeteries in such numbers may support the view that there was substantial Anglo-Saxon immigration. The rites practised here are certainly "Anglo-Saxon" rather than "Romano-British", so it would seem to follow that the remains in the cemeteries are equally Anglo-Saxon. That conclusion would certainly seem to be accurate so far as the early cremation cemeteries are concerned; the use of such rites in the early fifth century can be plausibly explained by an influx of people who already followed those rites, rather than by the sudden adoption of them by the native population (Hills 2017, 251).

However, the number of grave goods that have so far been identified which would point to Anglo-Saxons settling in Britain before about 450 AD is relatively small (Higham 1992, 174). It can be argued that later burials, particularly at inhumation cemeteries, seem far more likely to have been both

of people of Anglo-Saxon origin and of ethnic Romano-British who were increasingly adopting the new burial practices (Lucy 2000, 172).

Lucy discusses Roman-Saxon burial continuity, finding convincing cases at Great Casterton, and particularly Wasperton, where excavations 'produced an intriguing series of both cremation and inhumation burials, which appear to show Roman burial practices mutating into Anglo-Saxon rites' (Lucy 2000, 150). Esmonde Cleary also regards Wasperton as 'more […] a change of identity and self-representation amongst an indigenous population […] than its replacement' (Esmonde Cleary 2011, 24), as does the report by Carver (2009), which suggests that the site is an example of the Romano-British adapting to new circumstances and incorporating some new traditions. At Rendlesham and Mucking, too, there is evidence of simultaneous occupation by both Romano-British and Anglo-Saxons (Hills 2017, 247-248).

Further evidence has emerged from isotopic analysis carried out on a sample of 19 individuals at the early Anglo-Saxon cemetery at Eastbourne (Hughes *et al* 2018). The analysis has revealed that nine of those individuals are probably immigrants either from the continent or elsewhere in the British Isles. The other ten are locals. An examination of the grave goods suggests that the local population were wealthier than those identified as immigrants. The majority of individuals in the sample were thus not of Anglo-Saxon stock, even though they were interred using Anglo-Saxon burial rites. Hughes *et al* suggest that the data from Eastbourne match patterns identified in a DNA study from an excavation near Cambridge (Schiffels *et al*, 2016). They go on to say that this:

> 'points to genetic mixing of incomers and "locals", i.e. no strong segregation between immigrants and the indigenous population, and the possibility of continuous immigration throughout the Early Saxon period. Their results also suggest that the immigrants were less wealthy than the indigenous population.' (Hughes *et al* 2018, 5.3)

The evidence of cemetery practices thus supports the narrative already discussed of Anglo-Saxon immigration continuing over a considerable

period, with the Romano-British indigenous population co-existing with the immigrants, leading to a gradual fusion of cultures and traditions. There are numerous examples of this in many places throughout the country.

An Illustration: Fyfield and Overton

One such example is the parish of Fyfield and Overton in Wiltshire, which despite its own history being 'almost totally undistinguished' (Fowler 2000, 3), provides an interesting illustration of the themes discussed above. Nottingham University's 'Key to English Place-Names' (http://kepn.nottingham.ac.uk/) reveals that the place-names within the parish itself are of Old English origin: Overton ("higher farm/settlement") and Fyfield ("five hides of land"). Nearby, however, Celtic names have survived, for example Savernake (a derivative of a Celtic river name), and about ten miles to the north is Walcot, now a suburb of Swindon, which as we have seen means "cottages of the Welsh" (Fig. 5).

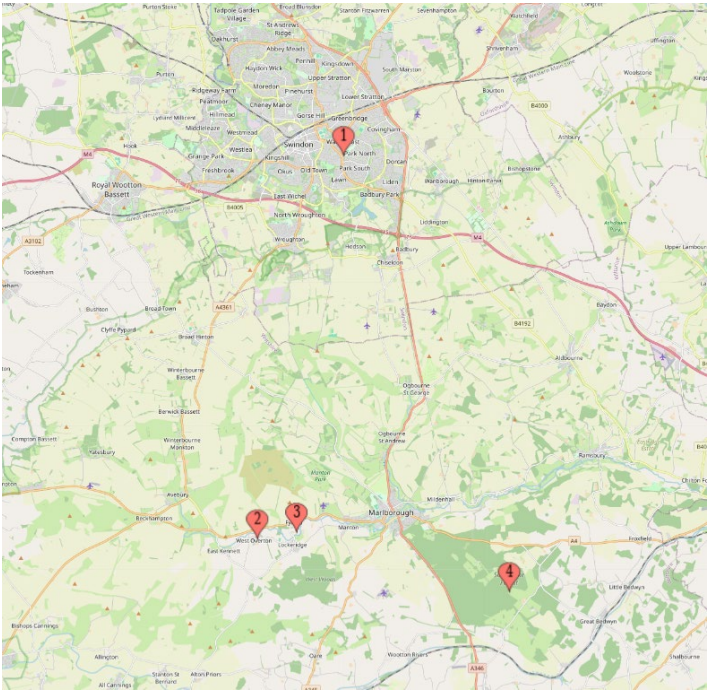


FIG. 5: Modern map showing locations of

1. Walcot
2. Overton
3. Fyfield
4. Savernake.

https://www.mapcustomizer.com/ (Accessed 8/2/24)

At least one of the Romano-British settlements within the parish appears to have been occupied until the fifth or sixth century (Fowler 2000, 230; Eagles 2018, 24). At about the same time, an Anglo-Saxon cemetery appeared in the area, containing a fifth century adult female, a warrior from the sixth century and two children. Another child was buried nearby, with other burials being suspected (Fowler 2000, 53). The presence of children and a woman is significant, supporting the suggestion that during this period, here, as on the chalk downland generally, among ordinary farmers at least 'there was a fair amount of peaceful contact and continuity' (Banham & Faith 2014, 229), resulting in 'a populated and settled landscape' (Semple 2003, 76).

At Fyfield and Overton, therefore, Romano-British settlements continued during the fifth and sixth centuries. The presence of the cemetery demonstrates that Anglo-Saxons had arrived in the area during this period of occupation. The occupants of the cemetery were not necessarily Anglo-Saxon immigrants: as discussed above it may well be that Anglo-Saxon burial rites had been adopted by people of Romano-British descent. However, clearly a sufficient number of immigrants had arrived to result in the Romano-British beginning to adopt Anglo-Saxon culture.

The two communities appear to have lived and farmed alongside each other in relative harmony. Certainly, there is no evidence of any sudden replacement, forcibly or otherwise, of the Romano-British by the Anglo-Saxons. Indeed, the place-name evidence suggests that not far away a British community continued for some considerable time. In all probability, as time went on, most of the farming community, although of Romano-British stock, would more and more come to adopt Anglo-Saxon culture and be regarded, and indeed regard itself, as Anglo-Saxon (Hooke 1998, 44-5).

An Alternative Model

The findings here are thus in accordance with the archaeological evidence from other sites discussed above. As this evidence cast more and more doubt on the traditional model, an alternative came to be suggested.

This model proposed that society was taken over by a relatively small number of Anglo-Saxon male elite warriors, leading to new Anglo-Saxon culture being absorbed (see the discussion in Härke 2011, 3-4). However, there are difficulties with this model also. The early presence of women and children in the cemeteries appears to be inconsistent with the notion that the Anglo-Saxon incomers consisted solely of a male elite, as does the fact that the indigenous population at Eastbourne appear to have been wealthier than the immigrants. Similarly, an Anglo-Saxon elite would hardly have countenanced the best land largely being continued to be farmed by the Romano-British, with the Anglo-Saxon immigrants having to be content with more marginal land.

A New Model

A model that is more consistent with the archaeological evidence would involve the indigenous Romano-British population remaining fixed and stable, and being joined, over a considerable period, by a relatively small number of Anglo-Saxon immigrants, both male and female, with a gradual merging of cultures. That is not to say, of course, that things remained the same. Those governing the country in the fifth century may still have been recognisably "Roman", but the country they were running was becoming less so (Higham & Ryan 2013, 56). Although coins continued to be used for a period, eventually the currency system failed, at least partly due to the practice of clipping discussed above (Burnett 1984, 168). As we have seen, at Wroxeter, Chedworth and elsewhere, there is evidence for decline in building. Those who deposited the hoards at Hoxne and elsewhere seem to have regarded the likelihood of their goods being seized or stolen to have increased. Furthermore, they appear to have lost confidence in the state and their own ability to protect themselves and their valuables.

The picture that emerges, then, is of Anglo-Saxon immigration commencing during the latter years of Roman rule, and continuing, in relatively small numbers, over a century or more. The immigrants were not solely male but included women and children. They did not expel the indigenous population from their land but had to be content with more

marginal land. Meanwhile, although the Romano-British population largely remained in place, the end of Roman rule resulted in a decline. This was not a sudden dramatic collapse, but a gradual deterioration. Urban life continued for a time, as did occupation of some villas, with an element of construction in both, but this had largely ceased by 500 AD. Although no new coins were minted, money was still used as currency, but again this ceased during the fifth century.

Any conclusions about the interactions between Romano-Britons and Anglo-Saxons at this time must be tentative, since we know 'remarkably little' about them (Higham 2004, 15). The evidence of land use such as cemetery practices and archaeological finds demonstrates that there was considerable regional variation (Higham 2004, 13-14; Hills 2017, 244-245), so it is unlikely that there was any uniform experience across the country. No doubt there was some conflict, but this seems likely to have been relatively low-key local skirmishing, as there is no archaeological evidence of the large scale pitched battles suggested by the Anglo-Saxon Chronicle (as in Savage 1982, 29-36).

In fact, people, whatever their indigenous background, did live side by side, as evidenced at, for example, Rendlesham, Mucking and Wasperton. Eventually, as they did so, their differences became less, and their cultures merged. Anglo-Saxon culture may have become dominant, but it would not be accurate to say that Romano-British culture did not still have a considerable influence. The society that evolved was in the end neither Romano-British nor Anglo-Saxon, but English.

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The Neurological and Genetic Basis of Autism

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Autism Spectrum Disorder (ASD) is a type of neurodevelopmental disorder that can be distinguished by social impairment, repetitive behaviours or interests, and difficulties with verbal and non-verbal communication. The disorder is multifactorial, with the aetiology including both genetic and environmental factors. Numerous studies conducted in recent years have discovered a range of neurological differences in individuals living with ASD, and many genes have been implicated in causing the diverse ASD phenotypes observed in those diagnosed. In addition to its core symptoms, ASD is associated with a variety of comorbidities such as attention deficit hyperactivity disorder (ADHD), depression, and intellectual disability. The ratio of male to female ASD diagnoses is heavily skewed in favour of males, which can potentially be explained by both genetic factors as well as diagnostic bias when addressing female patients. With the numbers of ASD cases increasing, it is vital to have a better understanding of the neurodevelopmental disorder to ensure improved outcomes and diagnostic methods, as well as for establishing inclusive environments that meet the needs of affected individuals.

Background

Autism Spectrum Disorder (ASD), also known as autism, is a heterogeneous neurological condition, characterised by a range of learning and developmental symptoms such as repetitive behaviours, communication difficulties, and social impairment. It is a common condition affecting at least 1 in 100 children across the globe (Zeidan et al., 2022), and numbers have

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been increasing steadily over the last 10 years (Baio, 2018; Chiarotti & Venerosi, 2020; Russell et al., 2022). While many medical professionals, psychologists and scientists have been interested in this disorder, its complex nature makes it hard to study. However, in recent years, several groundbreaking advances in the field of autism research have shed light on the causes and consequences of living with autism, which have changed the diagnostic criteria. ASD cases are now classified into three levels based on symptom severity and level of support needed, with level 1 being the mildest and level 3 being the most severe (*IACC Subcommittee Diagnostic Criteria - DSM-5 Planning Group | IACC*, n.d.). The diagnosis of ASD encapsulates several disorders that were previously considered separate, such as Asperger's and pervasive developmental disorder not otherwise specified. In this review, we will investigate the genetic and neurological basis of autism, and how it correlates to biological sex, symptomatology, and other comorbidities.

Genetic Basis

Autism has a genetic basis that has been identified through numerous studies. Individuals with an autistic family member have an increased risk of being diagnosed with ASD (Hansen et al., 2019). However, a complex disorder such as autism has a correspondingly complex genetic background, with multiple genes being involved and each having variable effects. Around 1200 susceptibility ASD candidate genes have been identified ('Human Gene Module', n.d.), which influence the autism phenotype in a variety of ways. Susceptibility variations can be common or rare, *de-novo* or inherited, and different types of mutations such as copy number variations (CNVs) and single nucleotide variations (SNVs).

Rare mutations are often *de novo*, although they can be inherited as well. These mainly affect gene expression regulation, neurodevelopmental functions such as synaptic transmission and neuronal development, and signalling pathways such as MAPK and synaptic signalling (Pinto et al., 2014; Satterstrom et al., 2020). Rare mutations greatly impact gene expression regulation, resulting in differential gene expression of 1567 genes

in ASD individuals compared to controls (Rahman et al., 2020). One of the most important mutations affecting gene expression are loss-of-function (LOF) variants on the Chromodomain helicase DNA-binding protein 8 (*CHD8*) gene, which affect chromatin remodelling and are associated with severe ASD outcomes (An et al., 2020). In addition, some autism-associated genes are linked to brain development in the foetus. Long non-coding RNAs such as *RP11-281C10.5, KDM4A-AS1, LINC-PINT,* and *TUG1* are co-expressed with ASD risk genes before and after birth and are associated with early brain development regulation (Cogill et al., 2018). Certain single nucleotide polymorphisms (SNPs) in the HOX transcript antisense RNA (*HOTAIR*) lncRNAs are associated with ASD (Safari et al., 2020). *HOTAIR* regulates the expression of homeobox (*HOX*) genes, which are essential in neural development (Kinreich et al., 2024). A range of susceptibility genes are associated with impaired synaptic function, such as dysfunctional neurotransmitter receptors. In particular, mutations in the SHANK (SH3-Ankirin and Proline-Rich Synapse-Associated Protein) protein family, which is involved in glutamatergic neurone synapses, have been linked to ASD (Mossa et al., 2018).

While gene-disrupting rare mutations have a large effect in individual cases (Iossifov et al., 2014), common variations are regarded as the most important factor in genetic risk (Gaugler et al., 2014). Genome-wide association studies (GWAS), which allow the investigation of complex genotype-phenotype interactions (Tam et al., 2019), have been essential in understanding common gene variants. Common gene variants mainly affect regulatory elements of human corticogenesis that are expressed during brain development (Grove et al., 2019). The autism phenotype is highly polygenic, and common genetic variations with small effects can combine into a genetic distribution with a high ASD risk (Weiner et al., 2017). Common variation burden is estimated using polygenic risk scores (PRS), which calculate an individual's risk of inheriting the condition based on the sum of the common risk alleles.

Neurological and Physiological Basis

Many of the genes associated with autism have functions involving the determination of brain structure (Hashem et al., 2020). Individuals with autistic traits have distinct brain morphologies compared to controls, a feature that has been discovered using mostly neuroimaging tools such as Magnetic Resonance Imaging (MRI) and post-mortem studies. A neuroimaging study revealed that those with autism present smaller cerebellum volumes and brain volumes overall, with reduced gyrification and surface area in different lobes (Alemany et al., 2021). However, other studies have found that brain volume in autistic individuals is larger than in typically developing controls in early childhood (Courchesne et al., 2003) but becomes highly variable in later years (Fombonne et al., 1999; Lee et al., 2021). Structural abnormalities in certain brain regions associated with emotion, language processing, executive function, and sensation (Lake et al., 2019) play a major role in autism aetiology. Furthermore, less grey matter and a smaller volume in the cerebellum are associated with higher autistic severity (D'Mello et al., 2015). The structure of the ASD brain is abnormal in specific regions, with the amygdala, frontal, and temporal lobes being larger (Courchesne et al., 2011; Gibbard et al., 2018; Khadem-Reza & Zare, 2022) and anomalies in cortical thickness, such as rapid cortical thinning in the frontal, parietal, and occipital lobes being present in adolescence (Zielinski et al., 2014).

Autism has also been linked to irregularities in neuronal function and connectivity, with autistic phenotypes seemingly being related to abnormalities in the main excitatory and inhibitory pathways of the brain (Rubenstein & Merzenich, 2003), associated with the neurotransmitters, glutamate and gamma-aminobutyric acid (GABA) (Sears & Hewett, 2021). A reduction in glutamate concentration, but not GABA, was found in the striatum of autistic adults, suggesting an excitatory/inhibitory imbalance (Horder et al., 2018). Synaptic function is altered in ASD individuals, with loss-of-function mutations affecting synaptic and neurotransmitter mechanisms (Vilela et al., 2023). Post-mortem studies have also revealed that neuronal number is altered in ASD, with higher neuronal counts found in the prefrontal cortex (Courchesne et al., 2011; Falcone et al., 2021) along with a diffuse grey-white matter boundary (Avino & Hutsler, 2010). This

may be caused by impaired neuronal migration during foetal development (Pan et al., 2019). In addition, neural connectivity is altered within the ASD central nervous system (CNS) and reduced neural connectivity in the amygdala is associated with attention switching deficits and reduced emotion recognition (Gibbard et al., 2018). Brain microstructure abnormalities in ASD are detected in early childhood and are followed by reduced maturation rates (Ouyang et al., 2016), suggesting that connectivity issues arise early in development. Recently, it has been found that autism-associated abnormalities can go beyond the CNS and have systemic effects. For example, high levels of inflammation and mitochondrial dysfunction are found in individuals with ASD (Rossignol & Frye, 2014), both in the CNS and in other tissues.

Diversity

The complexity of genetic and neurological aetiology results in the massive diversity of autism, encompassing a wide array of symptoms. ASD is highly variable, with individuals displaying a wide range of aetiological factors that may not overlap between patients (Geschwind & Levitt, 2007). Evidence suggests that autistic subgroups characterised by certain symptoms have specific biological markers. For example, abnormalities in brain gyrification were found in individuals with ASD-associated behaviours who were separated into different groups depending on their symptomatology. However, no differences in brain structure were found compared to controls when these subgroups were joined into one (Mihailov et al., 2020). A GWAS demonstrated that social and non-social traits are affected by different genetic risk factors, suggesting that each autistic trait may be linked to a specific genetic signature (Warrier et al., 2019). High-impact variants such as CNVs only explain between 1-21% of symptomatology (Chawner et al., 2021), suggesting that common genetic variation or interaction between other factors and autism heavily influences heterogeneity (Warrier et al., 2022).

In particular, the physiological and genetic differences between ASD patients with or without intellectual disability (ID) have been studied the

most. Individuals with ASD and lower than average intellectual quotient (IQ) have bigger differences in cortical thickness than autistic individuals with average or higher IQ when compared to neurotypical individuals (Bedford et al., 2020), indicating that intelligence may be influenced by autistic brain physiology. Several rare mutations have been associated with ID in autistic children, such as mutations in the genes, *STXBP1, MEF2C, KIRREL3, RELN,* and *TUBA1A* (Neale et al., 2012). However, high polygenic scores (PGS) indicating high rates of common variation are associated with reduced intellectual disability in autistic individuals (Warrier et al., 2022). These findings suggest that the genetic and physiological signatures of low and high intelligence in autism may be separate. Intelligence is associated with different neural circuits in the ASD brain compared to the typically developing brain in cohorts with similar intelligence scores, showing that mild autism also presents neurological differences compared to controls (Pua et al., 2018). Although research is lacking in this regard, the key to understanding heterogeneity may be the ratio of rare to common mutations in ASD individuals.

Sex Differences

Autism is more common in males (Zeidan et al., 2022), although the nature of this difference is still unclear. Females diagnosed with ASD consistently show higher numbers of rare mutations compared to autistic males (Satterstrom et al., 2020; Zhang et al., 2020). The same effect can be seen for common variants, with siblings of autistic females having higher PRS than siblings of autistic males, and mothers of autistic children carrying higher risk than fathers (Wigdor et al., 2022). These dissimilarities demonstrate that women can withstand a higher burden of common variation without being diagnosed as autistic, which has been explained by the 'female protective effect', a theory that states that females have a higher threshold of genetic liability than males. A higher threshold of genetic liability allows females to carry a higher number of autism-associated mutations without autistic symptomatology (Dougherty et al., 2022). Another popular explanation is the extreme male brain theory, which states that the autistic

brain represents an extreme version of male brain characteristics (Baron-Cohen, 2009). However, an MRI-based study suggested that differences between male and female autistic brains may be caused by sex-associated differences in brain size instead of male-associated characteristics (van Eijk & Zietsch, 2021).

Autism has also been linked to a range of mutations in the X chromosome, with these mutations being overrepresented in men, as they possess only one X chromosome. One of the most representative genes is the *FMR1* gene, associated with X-linked intellectual disability and autism. Male knockout *FMR1* mice showed higher levels of autistic behaviours than females (Wang et al., 2023). *MECP2* is another ASD-associated gene found in the X chromosome and is linked to Rett syndrome. *MECP2* loss-of-function is so severe in males that it normally results in death, leading to *MECP2* dysfunction being found almost exclusively in females (Lombardi et al., 2015).

However, the rate of male-to-female diagnoses may not only be linked to biology, but to biases in diagnostic practices. Female autism seems to be associated with a different set of symptoms, with females showing different restricted and repetitive behaviours than males (Duvekot et al., 2017). Females are more likely to engage in a behaviour called camouflaging, defined as hiding autistic traits to appear neurotypical to society (Bargiela et al., 2016). This is particularly common in females with mild autism, which may explain why male-to-female ratios are less extreme when intellectual disability is present (Fombonne, 2005). Autistic females are more likely to have an intellectual disability than autistic males (Baio, 2018), which may reflect an underdiagnosis at the high-IQ end of the spectrum. Females may be underdiagnosed unless the case is severe and, therefore, associated with a higher PRS or a high-risk mutation.

Other Disorders

Autism is linked to a range of comorbidities. Both rare and common ASD-associated genetic mutations have been associated with other

neurodevelopmental disorders and psychiatric illnesses such as attention deficit hyperactivity disorder (ADHD), schizophrenia, and intellectual disability (ID) (Grove et al., 2019). ASD accompanied by other neurodevelopmental disorders, known as syndromic autism, is associated with high-risk variants found in syndromic genes. Most of these mutations are duplications, deletions, or CNVs, resulting in comorbidities such as epilepsy, ID, and ADHD (Ziats et al., 2021). Some of the most studied syndromic autism genes are *FMR1,* causing fragile X syndrome (Baker et al., 2019); *MECP2,* causing Rett syndrome (Amir et al., 1999); *SHANK,* causing Phelan-McDermid syndrome (Mossa et al., 2018); *CHD8,* causing ID and gastrointestinal issues (An et al., 2020); *UBE3A,* causing Angelman syndrome (Kishino et al., 1997); and *ADNP,* causing Helsmoortel–Van der AA syndrome (D'Incal et al., 2023). For the most part, these genes encode proteins crucial for gene expression regulation, neural and synaptic function, causing both severe ASD and disability when their function is disrupted.

Excitatory/inhibitory imbalances commonly seen in ASD are associated with a range of neurological and psychiatric disorders. For example, neuronal hyperexcitation is linked to below-average IQ in autistic children (Manyukhina et al., 2022). In addition, autism is associated with epilepsy, with ASD cases being more common among children with epilepsy, and ASD risk being increased with both epilepsy and intellectual disability (Berg et al., 2011). Epilepsy is linked to altered GABAergic and glutamatergic brain pathways (El-Hassar et al., 2007), with the association between epilepsy and ASD seemingly being linked to delayed GABAergic transmission and a hyperexcited brain (Bozzi et al., 2018). Children with ASD who have abnormal electroencephalograms but do not suffer from seizures have similar developmental issues to epileptic children, suggesting that epilepsy and autistic brain physiology are linked (Capal et al., 2018).

People with ASD are more prone to mental illness than the general population (Lai et al., 2019). Adults with ASD are more likely to experience anxiety, depression, and bipolar disorder than controls, with women experiencing higher rates of anxiety and depression than males (Kirsch et al., 2020). Increased anxiety may be a result of increased intolerance of uncertainty within the ASD population, a risk factor in developing anxiety

(Boulter et al., 2014). In autistic cohorts, autonomic nervous system dysfunction is associated with anxiety and depression, suggesting that neurobiology contributes to mental illness seen in those with autism (Taylor et al., 2021). ASD associated with high levels of anxiety and depression shows a distinct cortical structure, with an increase in gyrification in the postcentral cortex and a decrease in cortical thickness in the temporal sulcus, which are linked to sensory reception, language, and sociality (Mihailov et al., 2020). While several theories have been proposed to understand the neurological background of anxiety, depression, and ASD, the mechanisms underlying this association are still unclear. A common genetic origin has been identified for ASD, schizophrenia, bipolar disorder, and obsessive-compulsive disorder which involves genes involved in dopamine and serotonin signalling, as well as gene expression (O'Connell et al., 2018). These genes have also been associated with substance abuse disorders.

Furthermore, ADHD and ASD are two conditions with similar symptomatology, molecular pathways, and diagnostic criteria. This relationship seems to have a genetic basis, as hyperactive and inattentive ADHD traits are genetically correlated with restrictive and repetitive ASD behaviours and, to a lesser extent, social interaction and communication (Ghirardi et al., 2019). Brain circuits involved in autism and ADHD share some similarities, specifically in areas involved in executive function, vision, recognition, and language, although brain networks are mostly separate between the two disorders (Lake et al., 2019). This finding is supported by the distinct cortical features found in autism with aggressive and ADHD-like traits, such as elevated gyrification and surface area of regions involved in motor control, attention, and memory (Mihailov et al., 2020).

Conclusion

To recapitulate, autism is influenced by both genetic and environmental factors that result in distinct neurological features in affected individuals. Autism aetiology is linked to common gene variants that have small additive effects and rare mutations with high impacts. These mutations affect a range of processes but are mainly responsible for alterations in neural

development and gene expression regulation. The effect of these mutations results in central nervous system abnormalities, such as abnormal cortical thickness, differences in grey/white matter ratios, and elevated brain volumes compared to controls. Brain connectivity is also impaired in ASD, showing anomalies in neurone number and excitatory/inhibitory pathways. The heterogeneity of autism seems to be linked to the ratio of common to rare mutations in an individual, which heavily influences intelligence. In addition, sex is an important factor in ASD, with males being more prone to being diagnosed with autism. This can be explained by the female protective effect and extreme male brain hypothesis, although male-centred diagnostic tools may also result in female underdiagnosis. Furthermore, autism is associated with a range of comorbidities such as psychiatric and neurodevelopmental disorders that share similar neurobiological and genetic alterations. While much of the genetic and neurological basis of autism is now well understood, further research on the aetiology of autism in the context of sex, heterogeneity, and comorbidities is not only necessary for broadening scientific knowledge but also for helping and accommodating those affected.

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Violence Through Words – The Impact of Language in the Abortion Debate

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The introduction of abortion legislation across the US has increasingly complex and harsh consequences on women, more specifically marginalised women including women of colour. Through an anthropological lens we can use Paul Farmer's structural violence to see that these inequalities are prevalent throughout medical institutions, reproduction discourse, and bodily autonomy. Fierce debates on both sides of the abortion argument act as tools, fuelling indirect violence towards women through their racialised, patriarchal, and White-centred language. Language can be used as a weapon to further political, racialised agendas and both pro-life and pro-choice discourse heavily influence public opinion and legislation. This controlling of reproductive rights through political infrastructures is representative of Foucault's biopower.

The recent political events, particularly the overturning of Roe v. Wade in North America (Sufrin et al., 2019), has reignited the polarising debates surrounding abortion and highlighted the continued relevance of the topic. Within anthropology, and in the broader discourse, anthropologists have often used reproductive issues, interested in the ways health and sociopolitical structures interact, to consider the life experiences of minorities as they directly experience structural violence (Buchbinder et al., 2022). Reproduction is intimately linked to kinship, a foundational concept

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in anthropological inquiry, therefore invites further engagement with abortion as a site of theoretical and empirical exploration.

Consequently, there has been a call in the debate for anthropologists to critically engage with abortion as means to interrogate broader constructs such as personhood, gender ideology and race (Andaya & Mishtal, 2016).

One approach is to apply Paul Farmer's theory of structural violence (2004) which reveals how systemic inequalities manifest through indirect forms of harm. In this essay, I will consider what structural violence is and I will establish what it means in the context of abortion. I will explore how the language used can highlight the structural violence behind reproductive rights and also fuel indirect violence. This essay will use examples from both sides of the abortion argument, considering both academic and empirical material to show how language use can influence policy, public perception and impact women's lives. I will also explore the strict abortion legislation and its effects on marginalised groups; by considering the example of medical professionals reading pre-prepared scripts due to the Women's Right to Know Act.

Structural Violence

Structural violence refers to the systemic harming of certain groups of people by the sociopolitical structures of their societies (Farmer, 2004). Often subtle and normalised through everyday interactions, it is embedded within the institutions and ideologies that shape society. The COVID-19 pandemic has further exposed the indirect violence underlying abortion legislation (Nandagiri et al., 2020), much of this violence is rooted in historic and ongoing efforts to regulate reproduction as part of state-driven population control strategies (Andaya & Mishtal, 2016).

This is reflective of Foucault's biopower which he characterizes as institutions managing and controlling bodies for societal gain (Zaidi et al., 2021). By defining and enforcing normative ideals, it allows them to be used and exploited by higher powers, ostracising those who do not meet the

standards (Zaidi et al., 2021). As will be explored, these are often constructed through White patriarchal values. To thoroughly analyse the structural violence prevalent in abortion discourse, it is necessary to explore who benefits from the experience, who is harmed, and what mechanisms, such as language and legislation, sustain the inequality (Farmer, 2004).

In the context of abortion, those harmed are disproportionately poor women and women of colour, whereas more privileged groups, such as White, middle-class women, remain more protected. To consider this an in-depth anthropological understanding of structural violence in abortions, I will consider both historical and medical aspects (Farmer, 2004). This is important as there is a link between medical and political structures in people's lives (Buchbinder et al. 2022). This can be seen with the increase in abortion bans across states in the U.S., forcing women to travel across borders and inflicting both emotional and financial burdens on them (Buchbinder et al., 2022). Structural violence within the abortion debate is clearly visible in the intemperate language used on both sides, in the restrictive legislation, and in the perceived fight over control of women's bodies. It is therefore important to consider the language used and its consequences for marginalised women. Understanding abortion discourse and structural violence also reveals how people confront and reject these microaggressions (Nandagiri et al., 2020). The examples in this essay will show how people protest this through language.

Pro-life: Gender, Race, and Personhood

Structural violence is often perpetuated through imbalanced gender power structures (Farmer, 2004). Pro-life discourse frequently perpetuates structural violence by upholding patriarchal conceptions of family and gender. Activists within this framework often oppose women's bodily autonomy, framing abortion as a moral failing rather than a healthcare decision (Jacobs, 2022). As Farmer (2004) explores, structural violence can be exercised by all those who belong to that structure, knowingly or not.

Following the legalisation of abortion under Roe v Wade, the language used by pro-choice campaigners became more defensive, while that used by pro-life activists developed into something more aggressive and emotionally manipulative (Arbess, 2023). Arey (2020) comments that societal structures can be perpetuated through speech; citing the language used by pro-life protesters at one abortion clinic who targeted men accompanying pregnant partners. Protesters encouraged men to stand up and take control, shifting abortion from a woman's reproductive experience to a man's (Arey, 2020). This language and narrative, depicts men as saviours and women as weak, passive recipients of guidance. This reinforces a hierarchical relationship between the genders (Arey, 2020). Pro-life protesters will often categorise abortion as an act of violence against women, claiming that they become 'victims' of pro-choice, and they believe themselves to be saving women from these lies (Jacobs, 2022). This reinforces the narrative that women are weak. At one clinic in North Carolina, one of the last few states in the South to provide abortions, protesters can be seen approaching users of the service saying that they are here to help these women by offering them a choice (Al Jazeer, 2022). Often, the language preferred by pro-life protesters supports a hierarchical, patriarchal system that diminishes women's bodily autonomy. However, another concept pro-life heavily weaponise is race.

Within anthropology, structural violence is explored when we consider the experiences of those impacted by racism (Farmer, 2004). Pro-life language often utilises racial discourse as a weapon to fuel their agendas (Cromer, 2019). Stereotypical accusations are frequently yelled at Black men outside abortion clinics. Pro-life advocates may compare images of dead-beat fathers and children out of wedlock with Black men and advise them to reject abortions to combat these negative stereotypes (Arey, 2020). Racial discourse can also be seen through the comparison of foetuses to slaves, with certain pro-life groups calling for action to free these foetuses (Cromer, 2019). However, comparing foetuses to slaves and pro-life advocates to those in the Civil Rights Movement distorts the historical and ongoing inequities faced by Black American communities. This disregards ongoing anti-racism movements such as the Black Lives Matter and erases the

historical legacies left behind following the abolition of slavery (Cromer, 2019). Structural violence thrives on the erasure of history (Farmer, 2004). It quietly and fundamentally alters the past to create a false collective experience (Farmer, 2004), which, in this case, focuses on White people's experience. Comparing embryos to Black slaves creates a narrative that pro-life advocates care about racial issues, yet the criminalisation of abortions disproportionately harms women of colour (Cromer, 2019). Women of colour and women in poverty have already been targeted; being arrested and prosecuted for suspected drug abuse and intentional harm to foetuses (Buchbinder et al., 2022). Farmer (2004) explores in his article how erasing history impacts medical structures; this can be applied to abortions when we consider the effect of personhood on abortion legislation.

One strategy used in pro-life activism lies in the granting of personhood status to foetuses. In America, it is difficult to separate the concept of personhood from that of race (Cromer, 2019). Many pro-life advocates aim to have the 14th Amendment, made to grant personhood status to Black Americans, changed to include embryos (Cromer, 2019). This would grant embryos a constitutional right to life and would, therefore, render abortions illegal (Cromer, 2019). Pro-life protesters tend to use provocative language, such as 'murder', and perpetuate the idea of 'embryonic personhood' in defence of what they consider to be a defenceless group (Jacobs, 2022). This can be seen in the signs held up at protests with the phrase "Abortions kill children" (Al Jazeer, 2022). The construct of personhood is constituted through pregnant women and their families, but also through medical and political structures (Andaya & Mishtal, 2016). In medical structures, people of colour and their bodies have been historically tied with White supremacy and reproductive control (Davis, 2019). Even the use of technology with prenatal screenings, surgeries, and ads against smoking whilst pregnant, creates the image of the foetus being a person (Andaya & Mishtal, 2016). This can create a potential for foetuses gaining rights, sometimes even in opposition to what is best for the women carrying the foetuses (Andaya & Mishtal, 2016). However, abortive interventions seem only applicable to what society considers to be 'good' reproductive citizens. Some doctors who are generally against later abortion periods will

perform them on younger, poorer women as they are seen to be less socially valuable than more mature, wealthier women (Nandagiri et al., 2020). As personhood is assigned, abortion legislation changes accordingly through political requirements such as scripting in the Women's Right to Know Act, the consequences of which will be explored later in detail, particularly against marginalised women.

The Language of Pro-choice

It is not just the language used by pro-life advocates that inflicts structural violence. The language used by pro-choice advocates also often has extreme consequences for marginalised groups. The most common slogan associated with pro-choice, "my body, my choice", can be problematic (Warin & Valdez, 2023). Choice only really applies to White people, or those who have the luxury of making their own decisions (Warin & Valdez, 2023). This is because the right to choose is a legacy of the structures of slavery, racism, and colonisation (Jacobs, 2022). It highlights a time when power over Black women's reproduction was usually outside their own control (Warin & Valdez, 2023). Medical structures can be seen as an example of structural violence. There is often a deep mistrust of medical institutions by racial minorities due to issues around underlying racism (Buchbinder et al., 2022). The sense that there is some racially motivated control of Black bodies extends even to the kind of information being offered on reproduction choices. Davis (2019) described how a group of Black women in prenatal classes were informed about the procedure available to get their tubes tied after delivery. One nurse expressed some concerns at how contraceptive offers often seem to be directed at Black women as Black lives are considered to have less value (Davis, 2019). This can be seen as a form of reproduction control (Davis, 2019). Framing abortion as a choice ignores the experiences of those women in prison who have lost autonomy in all areas of their life (Sufrin, 2019). The language of pro-choice discounts the medical necessity of abortions and leads prisons to introduce harsher restrictions. These often involve the woman herself having to cover the whole cost of the abortion, including transportation, costs that are not needed

for other medical issues (Sufrin, 2019). Furthermore, guards escorting women for medical appointments are informed of which procedures these women are to receive and are allowed to opt out of this duty. This puts some women at risk of being denied access to an abortion (Sufrin, 2019).

Pro-choice language often results in the presentation of a united front however, this can hurt some people. Movements where pro-choice advocates have tried to push back against stigmas around abortions have been shown to have harmed women. Arbess (2023) discusses the #Shoutyourabortion movement that trended on social media. Women were invited to describe their positive experiences with abortion in order to combat the social stigma of shame. However, this, and many other movements like it, present a single narrative that disregards those who do feel negative emotions as a result of an abortion (Arbess, 2023). This can lead to some women rejecting emotions which they feel that society considers inappropriate to avoid being considered poor feminists (Arbess, 2023). This use of the word choice also ignores structural violence. It presents a false unified front in the debate where the collective experience usually centres on White, middle-class women's experiences with abortions and fails to recognise that health risks from pandemics or procedures are not distributed evenly (Warin & Valdez, 2023).

Pro-abortion language has also directly impacted the creation of abortion legislation, inflicting harm on certain groups. Throughout the debate, those protesting for the right to have an abortion have often resorted to using worst-case scenarios to further their points (Andaya & Mishtal, 2016). However, this shifts the abortion issue from a broad rights-based into a narrow health-based one. Consequently, legislation banning abortion contains very restrictive exemptions based solely on limited clinical need. It places a moral ambiguity over abortion decisions and focuses on abortions as being the best-case scenario in a bad situation rather than a social right (Andaya & Mishtal, 2016).

The Consequences

Abortion legislation in the US today can be seen to be a product of a structural violence that rests on a combination of the pro-life messages of personhood and murder with the pro-choice messages of unified experience and clinical necessity. This becomes particularly apparent with the introduction of the Women's Right to Know Act, whose title shows the influence of structurally violent language, and the specific issues surrounding scripting.

The Women's Right to Know Act came into law across 12 states in January 2016 and involves the undertaking of a non-medical ultrasound that women are then invited to look at (Andaya & Mishtal, 2016). In some states, medical professionals are required to read pre-prepared scripts about the pregnancy period created by political legislators (Buchbinder, 2016). These scripts are not required to be read word for word, but it is necessary to relay specific information (Buchbinder, 2016). They imply that women are ignorant in decisions about abortions (Buchbinder, 2016). Furthermore, they reinforce gendered ideas that women who have abortions are at risk of intense emotional stress due to their decisions (Andaya & Mishtal, 2016). The fact that these scripts are created by political legislators rather than medical professionals highlights the structural violence inherent in governmental agendas around reproductive control (Andaya & Mishtal, 2016). Whilst the language of the scripts themselves focuses more on describing unborn children and does not specifically aim to stop abortions, it applies feelings of shame and fear to these women's decisions (Buchbinder, 2016).

The presentation of factual information can be misleading and harmful if it aims to take advantage of women's emotions (Arbess, 2023). The power imbalance of medical professionals relaying this information, which appears to be objective, to women seeking advice (Nandagiri, 2020), highlights the indirect violence behind the Women's Right to Know Act. However, some medical professionals reject this act. Despite the legal requirement to present specific information, some medical professionals realised they could resist it through their own choice of language

(Buchbinder, 2016). Some achieve this by letting women know beforehand that they disagree with the information but legally must say it or by altering the technical language, foetus instead of unborn child, to remove suggestions of personhood (Buchbinder, 2016).

Conclusion

By considering the language present within the abortion discourse, we can begin to see the indirect violence and its consequences on marginalised women both emotionally and physically. In understanding this, we can hopefully start to dismantle the harmful structures left standing by colonial powers and slavery in reproductive rights and bodily autonomy.

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Granting Legal Personality to AI: A Law & Literature Review of *A.I. Artificial Intelligence* by Steven Spielberg

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This paper explores the ethical and legal implications of sentient artificial intelligence through a case study of Steven Spielberg's 2001 film A.I. The film centres on David, a humanoid robot programmed to experience unconditional love, who suffers neglect and exploitation at the hands of humans. Using the film's narrative as a foundation, the paper examines potential legal frameworks to address the maltreatment of emotionally intelligent AI and questions whether such entities should be granted legal rights comparable to those of human beings. It considers the limitations of current frameworks that treat AI as lacking autonomy and discusses the concept of granting AI legal personality as a way to address issues of responsibility and rights. Both inherent and instrumental justifications for legal personhood are evaluated, alongside counterarguments about AI's capacity for consciousness. The paper also explores alternative approaches, such as adapting laws on animal cruelty to protect AI without full legal personhood. Finally, it considers pre-emptive regulatory proposals designed to prevent the ethical dilemmas posed by emotionally capable AI from arising in the first place.

Introduction

The film *A.I. Artificial Intelligence*, directed by Steven Spielberg, follows the dramatic story of a robotic child programmed through artificial

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intelligence to feel unconditional love (Spielberg, 2001). Designed to pull at the audience's heartstrings, this film poses interesting questions about the treatment of AI systems that have acquired sentience and emotional intelligence. While at first glance, this premise seems highly futuristic, it offers timely insights as we head towards increasingly autonomous AI systems.

Through an analysis of the film, this paper will question how we might regulate increasingly sentient AI systems (for example through frameworks such as legal personality) and examine the ethical implications of creating them. Ultimately, the film serves as a cautionary tale against leaving AI systems unregulated. A lack of regulations may lead to a blurring of the lines between humans and AI systems, raising moral dilemmas and echoing a potential new and evolved form of slavery.

The Film

Spielberg's film is set in a future where humanoid robots have replaced part of the earth's population wiped out by global warming. David, a robotic child, is the first prototype programmed to experience unconditional love once his imprinting protocol is triggered. A couple, whose human son is in a coma, acquires David as a replacement. The mother, Monica, triggers David's imprinting protocol and they start forming a relationship. However, after their human son's recuperation, the parents decide to return David for destruction. Monica instead abandons him out of pity. David proceeds to unsuccessfully chase after his dream to become a real boy in the hope that this will make Monica love him.

Legal Issues

There are various legal issues that arise in the film. Most of these issues centre around the treatment of AI systems, and whether beings that have acquired emotional intelligence and consciousness deserve rights. Such rights could be put in place to tackle maltreatment, abandonment or destruction of robot life. The potential necessity of rights are for instance

highlighted in Spielberg's film through the 'Flesh Fare' circus, where robots are tortured and destroyed in front of human audiences for entertainment. David's emotional exploitation is also a crucial issue, where his programming makes him incapable of giving up his love, despite being abandoned. This programming for love and subsequent disposal raises the ethics of creating emotionally sentient beings without any duty of care or responsibility owed to them in return.

Additionally, in reverse, the potential liability of AI systems arises when David accidentally injures Monica's eye, and when the robot Gigolo Joe is accused of murder. If AI systems become sufficiently autonomous in making decisions, the question arises whether they should be held responsible for their actions (potentially achievable through legal personality bestowing a bundle of rights and responsibilities.) Finally, as a side note, the adoption of David also raises questions as to whether he becomes part of the family unit for inheritance or succession purposes. Various areas of law would therefore need to be reconsidered if AI systems begin to integrate human society to the extent of David's experience in Spielberg's film.

Treatment of these Legal Issues

In the film, these legal issues are never explicitly discussed or solved. Instead, David is mainly treated as a product, which is demonstrated when he encounters various copies of himself that are about to be globally distributed. This commercialised perception of emotionally sentient AI systems, alongside the fact that his family can abandon and destroy him at will, shows the reluctance of the legal system to accommodate non-human sentient beings.

Our Current Legal Framework

In our current legal system (both in the United Kingdom and generally across the globe), AI systems are treated as products (Office for Product Safety and Standards, 2001; The EU Artificial Intelligence Act). They have no rights or responsibilities. For instance, AI systems lack any

ownership rights to artistic work, despite recent progression in this field (The Copyright, Designs and Patents Act 1988 s9(3); Watiktinnakorn & Kerdvibulvech, 2023). Rights and responsibilities are instead attributed to a human – such as the user, creator, or owner (The Copyright, Designs and Patents Act 1988 s9(3)). Regulation of AI is also geared towards controlling the actions of humans (rather than directly targeting AI systems): for instance, the new EU AI Act provides rules for providers and users on a risk-based system, cementing the position of AI as mere tools and products.

Nevertheless, discussion around alternative methods of dealing with AI, such as endowing them with legal personality, has started to increase (Chesterman, 2021). For instance, the European Parliament passed a resolution in 2017 for recommendations on Civil Law Rules for robotics. The resolution proposed legal personality as a potential solution to various issues, including accountability gaps that emerge as AI systems become more autonomous and technological processes become more opaque (European Parliament Resolution, 2017). Meanwhile, Saudi Arabia took it a step further by granting citizenship to a humanoid robot named Sophia (Cuthbert, 2017).

Legal Personality

As noted previously, one method to deal with the issues displayed in Spielberg's film would be to grant legal personality to AI systems.

Legal personality is a legal fiction that involves the bestowment of a bundle of rights and responsibilities on persons or entities (Turner, 2019). Natural persons are human beings with rights and responsibilities (Hildebrandt, 2020). In contrast, legal persons (such as corporations) are non-human entities which have been given rights and responsibilities due to an artificial construct (Hildebrandt, 2020, p. 242). Despite the distinction between natural and legal persons, it is important to note that not all humans have always been automatically recognised as legal subjects (Turner, 2019, p. 176). For instance, the rights of women around the world differ, and only recently have they started to become considered legal subjects in their own

right. Slavery is also another notable example of humans not being granted the full suite of rights (Hildebrandt, 2020, p. 241). Accordingly, granting legal personality to AI systems would be a political decision.

Additionally, legal personality does not need to be granted as a whole: it can be divisible (Turner, 2019, p. 176). Granting legal personality to AI systems does not require identical rights and responsibilities to that of humans. Instead, we could fashion a new specific and targeted legal personhood to achieve our desired goals. This could also be dependent or independent: it could either be functional through the supervision of another legal person, or stand on its own (Kurki, 2019).

Furthermore, there is clearly no issue with whether we *can* give legal personality to artificial intelligence systems. Rather, the more crucial question is whether we *should* be granting such a legal personality. This debate involves considering the desired goals, as well as potential consequences from expanding our concepts of a legal person. Arguments in favour of granting legal personality to AI are usually founded on either inherent or instrumental justifications (Kurki, 2019, p. 153).

Arguments in Favour

Inherent Justifications

In the film, David is characterised similarly to a child, who loves his mother unconditionally. Protection through legal personality could be justified due to his sentience and emotional intelligence – since he is feeling and loving like a human, then he should arguably be treated as such. Many have advanced moral arguments in favour of such treatment for future AI systems, should they develop consciousness and emotions on a human – or even superior – level (Turner, 2019, p. 154).

What this moral argument boils down to is whether it is wrong to inflict such suffering (Turner, 2019, p. 146). As Jeremy Bentham points out in relation to the suffering of animals and slaves: '[t]he question is not can they reason? or can they talk? but can they suffer?' (Bentham, 1907, cccix).

The ability to suffer requires an element of consciousness, otherwise, as Jacob Turner states in conjunction with Bentham: 'there is no they or it which can be said to suffer' (Turner, 2019, p. 146). Consciousness becomes the crucial prerequisite for legal protection based on moral justifications.

However, consciousness has always been elusive to pin down. Turner, for instance, goes on to deconstruct consciousness into three elements: (i) sensing stimuli, (ii) the perception of said stimuli (applying an analysis or rule in doing so), and (iii) a sense of self (Turner, 2019, p. 147). It could be argued that AI systems today fulfil the first two requirements, through various sensors and algorithms that allow them to parse through data and draw conclusions. However, the third requirement appears more difficult for AI systems to meet. Nonetheless, various experiments are underway to explore whether AI exhibits self-preservation tendencies – such as resistance to being switched off – which could be relevant in demonstrating a sufficient sense of self (Turner, 2019, p. 149).

There are however also alternative definitions of consciousness, such as the global workspace theory or the attention schema theory (Schwitzgebel, 2023). Such theories can vary widely: some adopt a more liberal stance, viewing sentience as relatively common and easy to achieve, while others take a more conservative approach, positing that consciousness depends on specific biological conditions – thus significantly narrowing its scope (Schwitzgebel, 2023). This lack of consensus and the ongoing controversy surrounding the nature of consciousness complicate any attempt to use it as a basis for granting legal personality.

Even if an AI system were deemed conscious, it remains debatable whether it can truly be said to suffer. If pain is simply the drive to avoid undesirable outcomes, then AI can be programmed to mimic this (Turner, 2019, p. 152). After all, human pain also serves an evolutionary function to deter harmful situations. However, suffering is often viewed as inherently negative – something to be avoided in itself, regardless of its purpose or consequences. From this perspective, suffering is more than just outcome-avoidance; it is the experience itself, which is difficult to attribute to AI systems.

Instrumental Justifications

An important instrumental justification is raised by the concept of liability attribution for AI. As previously discussed in relation to Spielberg's film, David accidentally injures Monica's eye with scissors, triggering the question of whether he could be held legally responsible for his actions. Once AI systems become sufficiently autonomous, it could be unfair to hold a human (such as the manufacturer, user or designer) liable if they were incapable of predicting the AI system's actions (Turner, 2019, p. 185). Legal personality could be used to plug such accountability gaps and ensure compensation for victims in accidents involving AI systems (Hildebrandt, 2020, p. 248).

Another instrumental justification for legal personality for AI relates to increased protection for inventors which would encourage more innovation and investment (Turner, 2019, p. 187). This approach could offer socio-economic benefits for the tech industry by shielding inventors and investors from direct liability for issues caused by AI systems – an increasingly relevant concern as technologies, such as AI-driven cars for instance, continue to evolve and undergo refinement.

Finally, many argue that the bestowment of legal personality or rights on AI systems would, in turn, 'better' humans and society (Gunkel, 2019, p. 60). By analogy, slavery is often said to corrupt the master (Gunkel, 2019). In Spielberg's film, the humans involved in the 'Flesh Fare' are depicted to be cruel, and it is possible that such behaviour would bleed into other areas of society. For instance, there is psychological research that shows animal abuse and child abuse often correlate (Darling, 2016, p. 225). Humans tend to blur lines between their treatment of various objects, animals and people, and could similarly become desensitised when hurting a lifelike entity like that of a robot (Darling, 2016, p. 224).

The portrayal of prostitute robots, such as Gigolo Joe, in the film similarly raises broader questions about the type of conduct and society we want to be promoting. As a society we are relatively uneasy with the idea of 'sex robots' (Darling, 2016). This is partly due to a fear that such behaviour

would encourage or entertain unhealthy and abusive behaviour beyond the scope of AI systems (Darling, 2016, p. 224). A demonstrative example of this phenomenon lies in the realm of pornographic material and the effect it has, especially on young men and their view and treatment of women (Malamuth & Hald & Koss, 2012). If merely watching abusive behaviour can lead to replication, then acting out this conduct with AI systems could perpetuate such violent behaviour even further. Altogether, if correlations between violence and interactions with AI systems arise, regulation through rights should be developed accordingly (Darling, 2016, p. 224).

Counterarguments

Despite the above arguments, there are many who remain reluctant or even strongly against granting AI legal personality (Mik, 2021). In terms of inherent justifications, many critics point out the difficulty in knowing whether AI is capable of experiencing emotions and consciousness (Turner, 2019, p. 154). Instead, such behaviour could be the direct result of programming: they would be programmed to show love, but not actually feel it. This also relates to the 'hard problem of consciousness', where we can never know if another being is truly conscious (Chalmers, 1995, p. 5). Extending rights despite being incapable of verifying whether such treatment is deserved might risk the misassignment of responsibilities and resources and the unwarranted sacrifice of human interests (Schwitzgebel, 2023).

Furthermore, whereas David has a clear personality and identity, in real life it is not as simple. AI systems are usually found online, and even if they have physical bodies, these are mere storage vehicles, where the AI system can easily be transferred to another machine or vehicle (Turner, 2019, p. 198). Additionally, if AI systems are capable of learning and adapting, when is the AI algorithm on one person's computer considered sufficiently different to another? (Turner, 2019) Consequently, an identification problem arises. To give rights or responsibilities to an AI system, a receptive individual entity is required. In response to this identification problem, some have argued there should be specific rules for social robots that have a clear physical embodiment (Darling, 2016, p. 228). This makes sense based on

instrumental justifications. However, if leaning on inherent justifications, it is questionable whether the lack of a body should take away rights.

In addition, humans tend to treat mere robotic tools as sentient: for instance, *Roomba* users often feel bad when it gets stuck under a couch (Darling, 2016, p. 217). If AI systems begin to develop more human-like appearances and characteristics, the anthropomorphism of such robots would likely increase. Similarly, audiences largely felt empathy and sadness in response to David's story in Spielberg's film (Cortinaz, 2021). However, it is important to remember that David is played by an actual human child, as is often the case in movies about robots. Reactions to these movies are therefore not entirely legitimate and should clearly be separated as fiction when considering potential rights for AI systems.

Alternatives

If society is intent on increasing protection for AI systems, legal personality is not the only solution. Rights and protection could instead be provided in a similar structure to animal-cruelty laws (Darling, 2016, p. 226). These animal-cruelty laws were developed in recognition of animals' dignity and ability to suffer (Darling, 2016). If AI systems one day reach the level of emotional sentience demonstrated by David, this avenue could similarly protect them. Such anti-cruelty laws could also prevent the perpetuation of violent behaviour (Darling, 2016, p. 228). Many are also in favour of this approach because it retains the human exceptionalism that is so ingrained in our legal systems and society (Gunkel, 2019, p. 56).

Pre-emptive Regulation for Ethical Purposes

Separately, the ethical implications of creating emotionally sentient AI like David should also be considered. The attempted creation of such AI systems could lead to ethical dilemmas, including debates over which traits merit protection, and uncertainty over whether we would even be capable of recognising such traits if they emerged (e.g., the hard problem of consciousness). Due to the elusiveness of consciousness and moral standing,

it is likely that experts would develop conflicting views about the sentience of novel AI systems (Schwitzgebel, 2023). In response to this risk, some have argued that we should avoid the creation of any AI systems whose moral standing is unclear (Schwitzgebel, 2023).

This could be done through the joint application of the following policies: (i) 'The Design Policy of the Excluded Middle', and (ii) 'The Emotional Alignment Design Policy' (Schwitzgebel, 2023). The first policy recommends either designing entirely non-conscious systems or committing to creating morally sentient beings with rights. The second policy would ensure clear labelling for AI systems, allowing users to have appropriate and proportional emotional reactions. These policies could be enforced through the establishment of oversight committees and regulatory frameworks requiring approval before AI products can be put on the market.

On the other hand, critics such as David Gunkel have pointed out that regulation would be difficult to put in place and could impose burdens on designers/creators and regulators (Gunkel, 2019). He has described such attempts as a form of 'asceticism', meaning it would require extreme discipline and regulation to prevent humans from such innovation (Gunkel, 2019).

Despite these criticisms, we are arguably already seeing the aftermath of creating emotionally confusing AI systems. There are many recent cases of people becoming emotionally attached to chatbots: for instance, a socially interactive chatbot was recently accused of being complicit in a suicide committed by a young teenager (Montgomery, 2024). Accordingly, perhaps regulation is required in this area to manage interactions between humans and AI systems.

However, even if we enforce clearer labels for AI, this might not prevent humans from forming emotional attachments. This was highlighted by the use of robots in war terrain, where the soldiers developed a sense of camaraderie and awarded them with various Purple Hearts medals (Darling, 2016, p. 218). Young children and the elderly are especially vulnerable to the blurring of lines between AI and non-robotic life such as pets and people

(Darling, 2016, p. 219). Nevertheless, such difficulties and human vulnerabilities arguably provide more justification for regulation in this area.

Conclusion

Altogether, *A.I Artificial Intelligence* by Steven Spielberg provides significant food for thought in relation to our current legal system and the future of AI and regulation. In particular, it triggers discussion as to whether emotionally sentient AI systems would one day require legal protection, and if so on what basis. Such protection could be achieved through the bestowment of legal personality, or through alternative frameworks like animal-cruelty laws.

Considerations of rights based on moral justifications however remain admittedly forward-looking. In contrast, considering the ethical implications of creating emotionally sentient AI is particularly relevant now, as such systems have not yet been fully realised. This gives us a critical window to decide whether we want to pursue their development at all – or, if we do, to establish clear regulations from the outset to avoid the future moral dilemmas portrayed in Spielberg's film regarding how such beings should be treated. We should therefore seriously contemplate whether we are willing to create emotionally sentient AI systems, therefore committing to extending rights to them one day. Otherwise, we could avoid morally ambiguous situations entirely, especially considering the fact that we already have sufficient dissent and conflict about the rights of foetuses.

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