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Foreword

The 2012 edition of the now well-established ANU Undergraduate Research Journal showcases some of the high-quality research being undertaken by undergraduate students across campus.

It is easy to forget the work is produced by undergraduates as you read through the 12 outstanding research papers contained in the following pages. Topics range across disciplines, covering areas from gender studies in British Uganda in the early part of the twentieth century to reducing car use in our local area.

What is particularly impressive about this unique Journal is seeing students getting a head start on academic pursuits and experiencing the ins and outs of peer-reviewed publishing. As the authors featured here move into postgraduate research positions, they will be familiar with the publishing process – from writing up their research, to submitting their paper to a journal and addressing reviewers’ comments. This first-hand knowledge will be an invaluable advantage in the early years of their academic careers.

Please join me in congratulating all the authors whose work is featured in the 2012 ANU Undergraduate Research Journal on their dedication and achievement.

Ian Young AO
Vice-Chancellor and President
The Australian National University
From the Editors

Innovating and explaining new and complex ideas about the world in which we live is a global challenge faced by many, but taken up by only a few. The Journal is a recent endeavour aimed at cultivating and encouraging the scholarly pursuits of analysing problems, proposing solutions and addressing key debates in Australian and international society.

As an interdisciplinary journal, we seek to extend this University’s community of scholars to the undergraduate realm while also providing a platform for interesting and novel thought. The Journal not only showcases the outstanding research of undergraduate students at ANU, but also provides an invaluable experience of the publication process where students receive reviews of their work from distinguished scholars at ANU as well as from other institutions.

In the spirit of scholarly inquiry, these articles attempt to explain how different parts of the world relate to one another in symbiosis. This symbiotic analysis and critique occurs through an exploration of a number of areas including the environment, the rule of law, romantic relationships, art, politics and media. The interconnectness of human life is both furnished and challenged within these articles.

The success of the Journal would not be possible without the contribution of the Vice-Chancellor, Professor Ian Young, the Dean of Students, Professor Elizabeth Deane, and Dr Dierdre Pearce, Project Coordinator, Dean of Students Office.

A number of academics kindly offered their time and expertise to review articles and in doing so continued the ANU tradition of passing on both their knowledge and their skills. We thank them for this important contribution. The delivery of this year’s Journal would not have been possible without the contribution and support of our team of ten Sub-editors. We greatly value their inter-disciplinary expertise, and the enthusiasm with which they approached a range of varied tasks. We also extend our gratitude to Aditya Chopra, Project Assistant, for providing advice and technical support, and to ANU E Press for their guidance.

Critical thought, research and writing is an iterative process. We hope that the skills and experience acquired in submitting a manuscript to this Journal will help prepare these undergraduate scholars to engage more broadly with their subject-matter, the professional field and with academia in the future. We congratulate them on their effort, persistence and desire to be part of the University’s contribution to scholarly inquiry.

Suzanne Akila, Laura Breen and Melanie Carmody
Editors 2012
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Joshua Bee

Josh is currently studying for Honours in Political Science, writing a thesis on rhetorical masking in the Australian same-sex marriage debate. Throughout his undergraduate study he has become alarmingly interested in lobbying, rhetoric, religion in politics, and democratic theory. Josh is eagerly awaiting the moment he can flee guilt-free to a beach, before finding his way back to pursue these interests through graduate study.

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Emma Best-Prothero

A local Canberra girl, Emma had always wanted to study Psychology so was thrilled to be offered the chance to study Psychology at ANU. Mid-way through her Bachelor of Science (Psychology) Emma found herself drawn more and more to the Sociology subjects she was taking as electives. Recognising the value of both fields, and not wanting to sacrifice Psychology for Sociology, Emma changed to the double degree of Bachelor of Science (Psychology) / Bachelor of Arts. A background in both disciplines, as well as the associated research and writing skills, has been beneficial to Emma’s career in the Australian Public Service. In 2011, she participated in the Sociology course 'Relationships, Marriage and Families', for which this article was written. This course inspired Emma to complete her Honours in Sociology. Her thesis explored the experience of teenage fathers within Australia.

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Wing Y. Chan

Wing’s passion has always been to investigate the ocean and marine life and she has now completed a degree in marine science at ANU. She became particularly interested in marine behavioural biology after taking BIOL2112 Marine Biology run by Dr. Pat Backwell, and then went on to receive the 2012 US Sea Education Association Presidential Scholarship. This award allowed her to conduct oceanography research during a 6-week cruise from Hawaii to Tahiti. Wing will undertake Honours in Earth and Marine Science at ANU in Jan 2013, investigating the effects of changing ocean pH on coral and marine life.

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Aman is a fifth-year Bachelor of Laws/Economics student. This essay was written as part of coursework for the Federal Judicial System course offered by the Faculty of Law and covers Chapter III of the Australian Constitution. Aman also wrote his Honours thesis during the second semester in 2012. The constitutional law thesis analysed an aspect of this essay, namely the "Kable doctrine". After graduating, Aman plans to work as a solicitor before undertaking graduate study in law or public policy.

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Galven is a third year Bachelor of Philosophy (Arts)/Bachelor of Arts joint degree student with the National University of Singapore (NUS) and The Australian National University (ANU). He is grateful for the opportunity to be exposed to Art History at ANU, an invigorating experience quite distinct from his usual interests in religious, social and cultural history. He enjoys researching and writing on the Charismatic Movement in Singapore Christianity, a research project that has brought him around Singapore to collect numerous oral histories, explore previously unavailable archives and even to London to interview a 94 year old retired bishop! He hopes to develop it into an honours thesis, and eventually a book. He enjoys giving his time to mentoring youths, explaining the gospel and thinking about the Christian faith, and sees little division between his academic and personal pursuits.

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Kevin Murray

Kevin is a third year Bachelor of Philosophy (Science) student specialising in plant molecular genetics and bioinformatics. He has an interest in the genetics of plant microbe interactions, which developed during an ANU Summer Internship research project on the plant pathogen Phytophthora. Kevin also has a keen interest in genomics and natural variation of genomes, which he hopes to pursue during his forthcoming Honours year and postgraduate study. This work was undertaken as part of the third-year biology course Advances in Molecular Plant Science.

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Elizabeth is in the third year of her Arts/Economics degree with an emphasis on environmental policy. This article was the result of an individual research project supervised by Rob Dyball of the Fenner School of Environment and Society, where Elizabeth spends a lot of her time. She hopes to address environmental issues in human contexts, such as urban form and energy policy. Elizabeth recently attended the Rio+20 UN conference on sustainable development and a short course at Yale University on sustainable institutions to further this goal.

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Jayne Regan

Jayne began her Bachelor of Arts majoring in History and English Literature at the University of Wollongong. She then transferred to ANU to undertake combined History and English honours, graduating in 2012. She is interested in postcolonial and Australian literature and history, and the Australian relationship to environment in particular. Jayne hopes to undertake postgraduate study at ANU in 2013, with a focus on Australian history.

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Tekle is a second year PhB Science student. In his first year he worked on an individual research project with Prof. Rob Stranger on molecular orbital theory. This research then led him to the field of computational chemistry supervised by Dr Germán Cavigliasso where he conducted the research for the article published in this journal. His motivation for this work was to study applications of quantum physics, and he aims to continue his study of physics and mathematics in the future.

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Jasmine is currently in the final semester of her Bachelor of Arts/Laws (Honours) Degree. Her main legal research interest is international law, which is complemented by majors in Spanish and history. Jasmine is currently editing her honours thesis on the interpretation of Article VIII of the International Convention for the Regulation of Whaling, which is the provision that exempts scientific whaling from whaling regulations. This thesis has allowed her to build
upon the analysis of Article 31 of the Vienna Convention on the Law of Treaties that she undertook in this piece on Article 1F(b) of the Convention Relating to the Status of Refugees by exploring how treaties can evolve over time to respond to changes in the attitudes of their parties, as well as developments in international law.

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Craig Wang

Craig is a third year student studying towards a B.Eng(R&D)/B.Sc double degree, majoring in Electronics and Communication Systems, and Statistics. Due to his specialisation in R&D for his engineering degree, he has completed three individual research projects, including a project at ETH Zurich in Switzerland while on exchange. After he graduates, Craig plans to pursue a career in Financial Engineering. He is the co-Founder and President of IAESTE Canberra, which is a global student organization that provides overseas internships for engineering and science students. Craig will be involved in a 2012-2013 summer research project at the CSIRO ICT Centre in Sydney to do further research in wireless technology.

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Gretal Wee

Gretal is a second year law student from Singapore who is also undertaking a minor in International Relations. Still in the process of exploring which area of law she wishes to specialise in, she appreciates the opportunities to pursue varying interests throughout her university life. Her lifelong passion is creative writing, for which she achieved first place in the 2012 ANU Short Story Competition.

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Bachelor of Visual Arts

*A luminous chorus* (detail), 2011

Porcelain, Mixed media

182cm x 28 x 28 cm, photographer: Greg Daly

I am fascinated by light, repetition and the translucency of porcelain. I find intimacy in repetition and am curious as to how extravagant numbers of a simple object can be assembled to create an elaborate work.

To create *A luminous chorus* I dipped hand-sewn lace squares in porcelain slip (suspended particles of clay to keep a fluid consistency), which were then fired in support cups to make individual objects with folds and shadows. Each light consists of thousands of pieces of porcelain assembled onto tall pillar-like structures lit from within.

Porcelain and light are mediums that enhance each other. When porcelain is thin it becomes translucent, allowing light to pass through a solid substance. Combining lace, porcelain and light provides me with a platform to explore works that emulate the stillness and beauty I experience from natural light wonders.
All at Sea: Romanticism in Géricault's *Raft of the Medusa*

Galven Keng Yue Lee

All at sea. We – receptacles, tentacles
Of ingestion and
Assemblage. A mass of ever-dying, ever-living
Vapid waves. All at sea.

~ Galven Keng Yue Lee

Plate 1: Théodore Géricault, *Raft of the Medusa*, 1819, oil on canvas, 491 x 716 cm.

Source: Musée du Louvre, Paris. Fair use is claimed for not-for-profit educational & scholarship purposes.

Abstract

Théodore Géricault’s painting, *Raft of the Medusa*, has long been regarded as a quintessentially Romantic painting. Yet it was unprecedented when it was exhibited at the 1819 Salon by its raw and direct appeal to the viewer’s
emotions, and represented an early stage in French Romantic painting. In this paper, I argue that the painting was an original, logical outcome of the social and political turbulence that plagued French society in the early nineteenth century and which also impinged itself on the personal circumstances of Géricault’s life. It is through this general malaise and sense of crisis that the painting can not only be seen as an authentic product of its time, but also one that reflected the distinctly personal nature of the Romantic painting, through the intense personal involvement and identification of Géricault with its creation and subsequent legacy.

**Romanticism in Géricault’s *Raft of the Medusa***

Théodore Géricault’s *Raft of the Medusa* is a stunning piece that strikes the viewer with its intense, emotional representations of hope and hopelessness. The pointless suffering of the denizens of the raft eradicate any pretensions to heroic achievement or tragic sacrifice; only the surging waves of the ocean respond without sympathy to their cries for salvation from a suffering which has only brought them to the pits of unheroic despair—drawing us within the vacant expression of the older man in the left foreground clutching onto the limp body of a younger male, possibly his son.

Unveiled at the Salon of 1819, when Géricault was 28 years old, it drew on and responded to the turbulent politics of the nascent Restoration regime of Louis XVIII.1 The portrayal of a vividly contemporary topic—the unfortunate incident of the sinking of the government frigate, *La Méduse* (*The Medusa*)—along with the attendant stories of carnage, cannibalism, mutiny and murder, which had scandalised the French public and embarrassed the Restoration government—especially one without celebrated heroes, didactic value or any attempts to narrativise its subjects as worthy of cathartic salvation after their travails at sea, appeared unseemly for a large (491 by 716 cm) history painting.2 Its carefully worded alternate title, *Scene of Shipwreck*, barely concealed its reference to the disaster that occurred just three years before. The French public had been informed about the torturous ordeal of the 150 people aboard a raft that was abandoned by the ship’s lifeboats, through the politiced inveotive of an eyewitness account written by the ship’s surgeon, Henri Savigny, and

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1 The Salon was the official art exhibition of the Académie des Beaux-Arts, and was sanctioned by both the Bonapartist and Bourbon regimes. It was held biannually, and held in high esteem in the Western world. The Restoration regime of the Bourbon monarch, Louis XVIII, was so-called because it represented the restoration of the monarchy in 1814. This followed the tumultuous years of the French Revolution in 1789–99, and Napoléon Bonaparte’s subsequent rise to power as First Consul, then as Emperor of the French from 1799 to 1814; Lorenz Eitner, *Gericault’s Raft of the Medusa* (London: Phaidon, 1972), 1, 5–6.

2 See Appendix A for Eitner’s narration of the *Medusa* debacle.
the engineer-geographer, Alexandre Corréard, which was intensely critical of both the ship’s captain as well as the favouritism and corruption in the royal administration that precipitated his appointment.3

But while Géricault was well aware of the politically sensitive nature of his subject matter, the figures in the painting are not portrayed to be the tragic heroes necessary to indict and demonise the regime for its failure. On the contrary, their complexions seem drained of warm hues and blend into the overwhelming, lustreless greys of the surging waves and overcast sky, evoking an implacable sense of death and decay. The focus on the human dimension of this tragedy can perhaps be read as implicit rebellion against the polemical debates and grand political themes that dominated much of the popular and artistic discourse of the day. Indeed, Géricault had observed that his friend Horace Vernet’s success as a painter stemmed from his choice of modern subject matter.4 Artists were also very much dependent on official patronage to finance their career; even the previously loyal Bonapartist, Baron Gros, was forced to exhibit the Embarkation of the Duchess of Angouleme at the 1819 Salon, which commemorated the princess’ resistance against the Bonapartists at Bourdeaux during the Hundred Days.5 In painting the Raft of the Medusa, Géricault acknowledged the pressures upon the artist to depict vital, modern and politically significant subjects, but subverted these constraints by painting a strikingly original scene that appealed directly to the viewer’s emotions and not through familiar guides to comprehension.6

This Géricault was able to do with creative abandon because of inherited wealth. He was one of several nineteenth century painters, including Eugène Delacroix and Gustave Courbet, without formal training in the academy.7 He could thus improvise from and synthesise various artistic inclinations and styles during a period of self-directed artistic development that coincided with the turbulent politics of his era. His was a generation that would have heard and witnessed the swift rise to power and expansion of the Post-revolutionary French Empire during his youth, only to see the entire edifice crumble during early adulthood with the restoration of the Bourbon monarchy, shattering the illusion of imperial military glory which they had grown up with.8 The brief return of Napoléon to power during the Hundred Days, though to no eventual avail, would have further deepened a sense of restlessness and weary disillusionment with the swiftly changing tides of history. In this post-Enlightenment world, the focus

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4 Ibid., 18.
5 The Hundred Days refers to the period after Napoléon escaped from exile to seize power once again as emperor. He was finally defeated at the Battle of Waterloo and lived in exile till his death; Frank Anderson Trapp, review of Géricault’s Raft of the Medusa by Lorenz Eitner, The Art Bulletin 58, no. 1 (1976): 134.
6 Ibid., 42.
7 Trapp, review of Géricault’s Raft, 136.
was shifting towards the subjective constructs of humanity, into the realm of personality, emotions and introspection, building on the humanistic base provided by the Enlightenment.

The industrialising, democratising forces that were both cause and outcome of the egalitarian and modernist ideas of the Revolution were themselves responsible for an artist like Géricault’s emergence. He was born into a wealthy bourgeois family, representative of a new elite that had consolidated its power and status under the Empire.9 This rising middle-class would not tolerate the unqualified hegemony of the aristocracy, but neither was it virulently anti-establishment. It was this tension between old world privilege and revolutionary modernity that Géricault inhabited. His wealth offered him the financial freedom to develop his artistic pursuits and pursue his passions for sportsmanship and horses unhindered.10 But he was also simultaneously plunged, in the year prior to beginning his work on the painting, into the midst of a rambunctious, pro-Bonapartist bourgeois community at Montmartre, where he lived at his father’s house. The central gathering place would be at the studio of Vernet.11 Their conversations must have revolved around the latest political and social events, plunging Géricault into an artistic setting that was consistently engaged with society. This tension between the old and new extended further to his artistic style, which sought to reconcile his appreciation of the grand, monumental Neoclassicist style of Jacques-Louis David with his passion for virile, fluid subjects. In negotiating between tradition and modernity, Géricault was one of the first artists of the nascent Romantic period to marshal these styles to suit the personal, human focus of the painting—a direction that was plausible for a comfortable middle-class gentleman in the stimulating and innovative intellectual climate of the Restoration.

This direction was made probable by the stormy circumstances of his private life in the years before the creation of the painting. Géricault had left for Italy in September 1816, intending to spend two years studying the monumental paintings of the Italian masters, but also to escape the sorrows of his forbidden, incestuous relationship with the young wife of his maternal uncle; he returned to Paris just one year later, driven back by loneliness and depression, eventually being forced to resolve his affair quietly after the birth of his illegitimate son in August 1818.12 The emotional toll that these events took on him was likely exacerbated by Géricault’s virile and flighty personality, easily given to engage in fights and thriving on intense experiences.13 Starting work on the painting in autumn of that year, he lived in seclusion for eighteen months, in a period

9 Ibid., 8, 10.
10 Ibid., 15.
12 Ibid., 12–13.
13 Athanassoglou-Kallmyer, Théodore Géricault, 15.
of relentless fascination and obsession with death—he collected cadavers and body parts, visited hospitals and beaches, enlisted the *Medusa*’s carpenter to build a scale model of the raft, and made numerous sketches, drawings and even paintings of different sections of the narrative. The tumult in the public sphere was mirrored by the despair of his private life, generating subterranean currents that would create the impetus that drove him indefatigably towards the horrific and macabre. In fact, the subject of the *Medusa* was arrived at after abandoning an initial project about the murder of Antoine-Bernardin Fualdès, a former Jacobin who was allegedly murdered by right-wing, royalist extremists. Evidently, Géricault was becoming preoccupied with expressing an artistic vision that revealed the haunting contours of his imagination, an unfettered look within the nature of humanity, one he was free to explore as an artist not beholden or accountable to his patrons.

The forces impinging upon Géricault that pushed him in such a direction were by no means unique to him. Yet it is the intriguing and highly personal manner in which he was urged by the circumstances of the public and private spheres to create a painting that provides a rich insight into the emergence of Romanticism as an early response to those tumultuous times. It was also a protest against the failure of rationalism and the bankruptcy of appeals to grand concepts such as ‘Empire’ or ‘Nation’ to deliver stability and peace. As the French poet and critic Charles Baudelaire noted in 1846, at the tail end of the Romantic movement: “Romanticism is precisely situated neither in choice of subjects nor in exact truth, but in a way of feeling.” In contrast with more uniform styles like the Baroque, supported by the Church and containing more distinctive subject matter, the Romantic eludes programmatic definition because it comprised a diverse reaction against prevailing styles. The fluid, asymmetrical motion of the figures in the painting and the realist depiction of raw emotion lie in stark contrast to the restrained forms and inner rationality of Neoclassical archetypes like David’s *Oath of the Horatii*. In its retreat towards the inner world of emotion, Romanticism could only serve to reinforce the personality of the artist himself as being central to the creation of his art—not only was the Romantic painting the product of its times, it was these trying times that became the implicit subject of, and were given their fullest expression on, the canvas. By the time it was due for exhibition at the 1819 Salon, Géricault had evidently exhausted himself

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15 The Jacobin club was the most radical French political club during the Revolution and was responsible for implementing the Reign of Terror, when thousands of people branded as ‘enemies of the Revolution’ were executed. Fualdès had also allegedly voted for the execution of Louis XVI. His murder coincided with the White Terror, when royalist gangs swept through France to purge their political opponents between 1816 and 1817. Suspicion of official involvement lingered even though the case was eventually attributed to simple robbery: Athanassoglou-Kallmyer, *Théodore Géricault*, 119, 122.
17 Ibid.
through the long hours and depressing themes that infested his art. He left for the country to rest, but his physical and mental condition soon deteriorated to the point where his friends brought him back to Paris to seek medical help.\textsuperscript{18} The Romantic artist, fixated on the subjective realms of individual experience and emotion, and who embraced the complexities of life in its phenomenological reality, soon became indistinguishable from his art.

Such conventions of the Romantic can only be observed with hindsight. Géricault did not set out to create a Romantic painting. His coming of age in the 1810s was a period where the Neoclassical style of David was getting tiresome, lacking the genuine conviction of public duty and patriotism that had marked its origins in the last quarter of the previous century.\textsuperscript{19} Napoléon had officially intervened to introduce a new category of history painting that depicted modern scenes with militaristic themes.\textsuperscript{20} Géricault must have been inspired by these monumental paintings of contemporary glory to paint the \textit{Portrait of an Officer of the Chasseurs Commanding a Charge}, which was well received at the 1812 Salon (Plate 2).

His ambition was “to shine, to illuminate, to astonish the world”, and he had succeeded in combining two seemingly contrary instincts that had been with him from his early development—a tendency towards vitality and realism, and the grandeur of colossal images.\textsuperscript{21} But his next Salon painting, \textit{Wounded Cuirassier Leaving the Field}, demonstrated the limitations of this realism in sustaining monumentality (Plate 3).

Disappointed, Géricault turned to the formal, controlled style of Neoclassicism, expressing his individuality by exuding an intensity that was more reminiscent of Michelangelo than David.\textsuperscript{22} This style he refined in Italy, reflecting once again his tendency towards the contemporary and realist, channelled with greater control and monumentality with its grand classicism, in \textit{The Race of the Riderless Horses} (Plate 4).\textsuperscript{23}

\textsuperscript{18} Eitner, \textit{Géricault’s Raft}, 57.
\textsuperscript{20} Ibid.
\textsuperscript{21} From a manuscript by Géricault, quoted in Charles Clément, \textit{Géricault, etude biographique et critique} (Paris, 1867), 249, quoted in Eitner, \textit{Raft}, 15.
\textsuperscript{22} Eitner, \textit{Géricault’s Raft}, 16.
\textsuperscript{23} Géricault made several studies for this project, but failed to complete it.
Plate 2: Théodore Géricault, *Portrait of an Officer of the Chasseurs Commanding a Charge*, 1812, oil on canvas, 349 x 266 cm.

Source: Musée du Louvre, Paris. Fair use is claimed for not-for-profit educational & scholarship purposes.
Plate 3: Théodore Géricault, *Wounded Cuirassier Leaving the Field*, 1814, oil on canvas, 358 x 294 cm.

Source: Musée du Louvre, Paris. Fair use is claimed for not-for-profit educational & scholarship purposes.
These circumstances gave rise to the Géricault who would produce the quintessentially Romantic painting of the *Raft of the Medusa*: an irrepressible individuality that sought to portray lived experience rather than mythological irrelevance, a well-honed style that was formal yet eschewed dynamic restraint, the inner turmoil of his private woes and a disillusionment with the social and political upheaval of those years. His modern artistic vision that focused on the individual and expressed the complexity of the spirit of the times was nurtured and encouraged in this milieu, turning from the sketches of soldiers, sportsmen, and horses of his early youth to the contemporary, contentious, vital subject of the *Raft*, which he thought would grant him the attention and recognition necessary to ‘astonish the world’.

The painting is an unresolved, existential plea for redemption that transcends the superficial, political veneer of its subject matter. Géricault’s work presents a cascade of emotions that seem to ascend and descend between hope and despair, yet offer no true resolution, only a sense of vacant, emotionless ambivalence. Its composition is marked by two divergent, intersecting, pyramidal structures—one running from the deceased male on the left extreme of the foreground, to the tip of the cloth which the dark-skinned man is waving in the air; the other
beginning from the faceless body of the deceased figure on the right extreme of the foreground, running to the top of the mast. The former seems to show a growing transition from despair to hope, contrasting the desolate stare of the father figure and the deceased bodies littering the wooden planks of the raft with the apparently desperate but hopeful gestures of the half-kneeling, half-sitting figures reaching out, upwards to a crescendo of salvific longing topped by the dark-skinned man, waving at the Argus, its mast faintly peeping out of the horizon.24

But there is no certainty of redemption, no satiation of the horrors of the fourteen days past. The figure in the centre, caught between the shoulders of the men with outstretched arms, almost seems to express a distressed torment, with his intense, yet emotionless expression, as if being repressed by the other two. Nature herself seems at odds with the frenzied hopes of the men on the raft, blowing gustily with an almost preternatural strength that causes the mast to billow leftwards. It seems almost cruel that instead of blowing directly away from the Argus, the wind is taking them on a course parallel with the Argus on its picture plane, prolonging their torturous uncertainty, the moment between assured jubilance and monumental dejection. The viewer cannot detach himself from the mental torment of the scene—the raft seems to extend outwards into the viewer’s space, drawing and engaging him as a horrified participant onto this wooden contraption that does not seem far from coming apart. There is no true hope in this picture, only longing, whose outcome is rendered inconsequential by the irreparable sense of loss and decay that pervades the picture, epitomised by the figure of the father.

This figure, his left arm bulging with unnatural strength, is the only one who faces the viewer, perhaps assuming the role of the storyteller in conventional history painting. His well-developed musculature contrasts starkly with the limp torso of the son, whose red hair and lithe frame suggests an innocence that has been terminated with death. His absence of sentience and awkward posture makes his unclothed form border on the boundary between nudity and nakedness; the former connoting the rationalised acceptability and beauty of ideal form, the latter suggesting an intrusive, voyeuristic realism that borders on the vulgar.25 His open palms almost beckon the viewer to contemplate him not as a classical, archetypal nude, but signify an opening into a disturbed inner world.

The horror of this inner world stalks the painting with a clear reference to cannibalism—Salon visitors noted the similarity to portrayals of Count Ugolino,

a notorious character in Romantic poetry and art, suspected of practising cannibalism on his sons and grandsons, such as in Henry Fuseli’s *Ugolino in the Tower* (Plate 5).26

Plate 5: Henry Fuseli, *Ugolino in the Tower*, Engraving by Moses Haughton, 1809 (after Fuseli’s painting of 1806), ink on paper, 61 x 44 cm.

Source: The Trustees of the British Museum. Fair use is claimed for not-for-profit educational & scholarship purposes.

26 Eitner, Géricault’s Raft, 45.
Géricault’s earlier sketches reveal the genealogy of this father figure, originally a brutish cannibal, gradually transformed into the grieving father, his visage perhaps expressing not merely grief, but remorse (Plates 6–9). The bloodstained bandage on his left forearm hints at the position where his brutish ancestor had bit into his victim, heightening the repugnance of having eaten his flesh and blood, tantamount to eating himself (as the bandage demonstrates), the innocence of his son rendered meaningless by death—a death which our storyteller has partaken of; the vacancy of his expression a mark of the very lifelessness that overwhelms the painting.

Plate 6: Théodore Géricault, *Scene of Cannibalism*, 1818–1819, crayon, ink wash, and gouache on paper, 28 x 38 cm.

Source: Musée du Louvre, Paris. Fair use is claimed for not-for-profit educational & scholarship purposes.

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27 Notice how the brutish cannibal in Plate 6 is manifested in the two characters of the brute (in body structure) and the grieving father (in posture) in Plate 7. This grieving father subsequently transits to his final form in Plate 9. Géricault has experimented with multiple incarnations of numerous forms and figures, involved in acts of mutiny and cannibalism, and this grieving father has emerged from his earlier cannibalistic existence; Darcy Grimaldo Grigsby, *Extremities: Painting Empire in Post-Revolutionary France* (New Haven: Yale University Press, 2002), 201–11.

28 Ibid., 215.
Plate 7: Théodore Géricault, *Study for Raft of the Medusa*, 1818–1819, oil on canvas, 38 x 46 cm.

Source: Musée du Louvre, Paris. Fair use is claimed for not-for-profit educational & scholarship purposes.

Plate 8: Théodore Géricault, detail from *Study for Raft of the Medusa*, 1818–1819, oil on canvas, 38 x 46 cm.

Source: Musée du Louvre, Paris. Fair use is claimed for not-for-profit educational & scholarship purposes.
Death stalks the painting. Its horror accrues not from depicting scenes of mutiny, cannibalism and disordered chaos, but from the knowledge that this depicts the aftermath of a bloody narrative. These are characters forever marred by an unforgettable memory of the abominations that have occurred. The bloodstained axe head on the right, the headless body of the shrouded figure in the right foreground, the torso of the man in the extreme left foreground—his bloated, putrefied hand and triangular gaping wound beneath his ribs and the absence of his lower body—together provide chilling hints of the original
But death lives in life, too—not just in the father-son combination, as we have seen earlier, but in the mish-mash of bodies, torsos, limbs, dead and living, fused in the ensemble of movement characterised by the receding diagonal of the pyramid. This pyramid consists not of disparate characters, but a fused collective; its fluidity of motion accomplished by the outstretched arms and the gradually accelerating curve of the pyramid that achieves a speed that simultaneously dismembers and reassembles the collective.

In dismembering, this amalgamation of bodies becomes little more than a contortion of body parts—the flickering Caravaggesque *chiaroscuro* accentuating this cacophonous, tense fusion. Dead and live body parts intersperse with little distinction, such as the black man to the right of the painting, whose mouth lies close to the buttocks of the red-haired, youthful figure; the array of dead figures foregrounding the picture from left to right shroud the rest of the figures in the picture with a deathly pallor. This is but the meat of the cannibals: a “fricassée”, in the words of one Salon critic. Dismembering results in reassembly. Irrelevance of difference between living and dead is mirrored by the indistinguishable characterisation—it is impossible to discern nationality, social status, and perhaps even race; the two figures closest to the right of the masthead, silhouetted in the darkness, could be Caucasian, African, or Asiatic, while the straight forehead and bearded visage, along with slightly upturned nose and prominent lips of the darkened figure in profile at the centre of the painting combines the Grecian and African models from a previous sketch (Plates 10–11); his position in the shadow engulfs him in a darkness that reveals nothing of his skin colour. The cannibalistic consummation of the collective has brought them into an egalitarian communion that transcends the hypocrisy of Savigny and Corréard’s narrative. This communion affirms a utopian vision of universal fraternity, capped by the dark-skinned figure at the apex of the pyramid, but nevertheless a vision that is built on the unspeakable carnage of self-consumption.
Plate 10: Théodore Géricault, *Study for the seated Man on the "Father’s" Right*, 1818–1819, medium and dimensions unknown.

Source: Dubaut collection, Paris. Fair use is claimed for not-for-profit educational & scholarship purposes.

Plate 11: Théodore Géricault, detail from *Raft of the Medusa*, 1819, oil on canvas, 491 x 716 cm.

Source: Musée du Louvre, Paris. Fair use is claimed for not-for-profit educational & scholarship purposes.
Thus, this nightmarish inner world presents a hope that is perhaps unattainable—the egalitarian communion, representing Géricault’s idealised world, loses its lustre as it is only conceivable in its perverted manifestation as a cannibalising fricassée that destroys itself from within. In Géricault’s diseased world, the world is not only beyond redemption, but is also irreversibly and eternally disordered, alienated from the discourse of any narratives of redemption. Hence, this Scene of Shipwreck is irrevocably ‘shipwrecked’, turning the noun into its adjectival form; replacing the continuous diachrony of narrative with synchronous instantiation: a discordant, displaced eternity of a moment, forever lost, always reaching towards distant hope, all at sea.35 Géricault has departed the public and particular political spectacle of the Medusa for an inner landscape that universalises the painting with sublime emotions of lostness, a rumination on humanity that was not uncommon for his generation. The painting’s only source of illumination emits from a point towards its right, suggesting a rising or setting sun, near a ship that might or might not come to their rescue. The expected warmth of the orange hues of sunlight is pale and drained of vitality, overshadowed by the greys of billowing clouds and greyish greens of thundering waves. Darkness haunts this picture—the projections of a mind fixated on death, despair and lostness.

Géricault’s painting reflects the Romantic temperament as much as it paved the way for others to follow his synthesis of painterly realism and ideal forms. Its subordination of outer, idealised rationality to inner, subjective experience, fixated on the morbid, pushing towards the extremities of suffering and a loss of innocence, express not a message but a sense of the tragic, rooted not in the teleological redemption and resolution of Classicism, but in a persistent turbulence that channels the vast ambivalence of human experience. It is Romantic in emphasising an associative side that suggests a deeper reality encountered through the sublime; the open form, unidirectional movement in the painting that brooks no obvious consummation, and not the organised, narrativised nounal of the ‘shipwreck’. The father figure as true story teller, plumbing the sombre realities of the human condition; not the figures of Savigny and Corrédard, who gesture toward a false hope, speaking yet dissolving into the darkness, gagged as storytellers.36

The painting’s contemporary reception by critics reveals less about Romanticism itself than the conservative forces of the Ancien Régime that it was rebelling against. There is little information about its public reception, though it must have captured the public’s imagination with its unconventional style and prominent

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36 Géricault has painted Savigny and Corrédard as two figures standing beside the masthead; Vaughan, Romanticism and Art, 11.
place in the critics’ reviews of the Salon. Critics were in general agreement that the painting reflected the work of a master, but bemoaned the uniform darkness of its colour. More interestingly, their criticism appeared to be divided by political affiliation, with the Liberals and Romantics proclaiming admiration for its subversive, beautifully executed horror and the Conservatives and classicists condemning its unheroic and morally bankruptcy with its repulsive depiction of death. The Liberal and Romantic critic of Le Constitutionnel wrote: “My heart trembled upon seeing the shipwreck of the Medusa … I shudder while I admire.” In contrast, the classicist critic of Le Courrier berated Géricault: “So, I am asking, twenty or so unfortunate men abandoned in a raft … does this present a good opportunity for the brush to exert its talent?”

The important observation is that both sides coloured their reviews of the painting through highly polarised lenses that overlooked its originality in the impact of its confronting and emotional pleas on the viewer, but instead employed a stock discourse that reflected the vast divisions in French politics of the time. Ironically, the critics’ reviews validated and affirmed the Romantic artist’s campaign as a valid response to the polemical artifice of the status quo. It demonstrated the painting’s resilience in refusing to be drawn into contemporary politics, but in pioneering a style that would only flourish in the years after Géricault’s death. Géricault died five years later in 1824, and his desire to ‘astonish the world’ would be fulfilled posthumously. In time, this painting would only grow in its potency as a Romantic symbol due to its association with the emerging myth of Géricault as the heroic, brooding Romantic artist. This legacy was firmly enshrined in the 1830s with Ary Scheffer’s painting, The Death of Géricault, circulated in lithographs and which cemented his identity as a Romantic martyr (Plate 12).

While Géricault’s painting incorporates the ostentatious expressiveness of the Baroque, the monumentality of its figures also reflects the deep, inner sentiment of the Neoclassicist. These continuities flow unapologetically into his work, but serve to strengthen, rather than erode the robustness of the Romantic enterprise. Because the Romantic was premised on a response that meant a shift in paradigms—from traditional archetypes and an idealised notion of art to a more self-referential, darkly emotive and deeply personal orientation—Géricault was able to give these preceding styles a transformative interpretation that did not invent a new technique as much as it meant a more intuitive, expressive depiction of personality and emotion. The Raft of the Medusa demonstrates how

37 Eitner, Géricault’s Raft, 57–8.
38 Athanassoglou-Kallmyer, Théodore Géricault, 138.
39 Ibid., 138, 144.
40 Le Constitutionnel, 26 August 1819, 195, quoted in Eitner, Géricault’s Raft, 58.
42 Athanassoglou-Kallmyer, Théodore Géricault, 211.
this nascent Romanticism is the complex product of a society and individual irrevocably shrouded in a time of crisis. The personal tragedies in his life were crises that were only made possible by the crisis faced by an emerging middle-class that strove to define itself and find its way out of the stagnant waters and “contrived reconciliation” of Restoration-era France.43

Plate 12: Ary Scheffer, *The Death of Géricault*, 1824, oil on canvas, 36 x 46 cm.

Source: Musée du Louvre, Paris. Fair use is claimed for not-for-profit educational & scholarship purposes.

The sublime indeterminacies of a complex inner world would be but a brief respite for Géricault from the crises of his life, having witnessed the rise and fall of the Empire, the return of the Bourbons, the Hundred Days, the Restoration, forbidden love, declamatory ambition, and having endured his many temperamental passions. This retreat into a diseased and disordered inner world would further pull him towards his destruction, with a despondent statement he made following the lukewarm reception to his painting taking on prophetic

43 Ibid., 8.
tones: “What I want is the trial of misfortune.”44 Carried along the waves of history, the emerging Romanticism of his era enabled Géricault to project in the *Raft of the Medusa* his vision of unheroic desolation and ‘shipwrecked’ abandon to the extremes of unmediated emotion, rocking him further out to sea as a talisman for others who would follow in his wake. All at sea.

**Bibliography**


**Appendix A**

The *Medusa* debacle is narrated in Lorenz Eitner’s publication *Géricault’s Raft of the Medusa*:

On 2 July 1816, the government frigate *La Méduse*, flagship of a convoy carrying French soldiers and settlers to the colony of Senegal, struck bottom in shallow water close to the West African coast, south of Cap Blanc. The main cause of the mishap was the incompetence of the

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captain, Hugues Duroys de Chaumareys, a nobleman and returned émigré, who owed his appointment to ministerial protection rather than to his seamanship. Outrunning the smaller ships in his convoy, de Chaumareys had steered an erratic course through the shoals along the Mauretanian coast, with the result that, when he ran aground on the sands of Arguin, there were no ships near him to help re-float the Medusa. After two days of confused and ineffectual efforts, it became apparent that the ship must be abandoned. Only six lifeboats, of various sizes and different degrees of dilapidation, were on hand. They could take no more than about two hundred and fifty of the Medusa’s four hundred passengers and crew. To accommodate the rest, a raft measuring about sixty-five feet in length and twenty-eight feet in width was built with the help of masts and beams crudely lashed together with ropes. On the morning of 5 July, the frigate, which had begun to break up, was abandoned with undisciplined haste. The captain and many of the senior officers, concerned only with their own safety, had the brutality of commandeering the more seaworthy boats, leaving it to the lower ranks and the soldiers to try their luck on the Raft. One hundred and fifty persons, including a woman, were herded onto the slippery beams, which immediately submerged under this weight...

An agreement had been made beforehand that all the boats should stay with the Raft and together tow it to the nearby shore. But in their haste to reach land, the men in the boats soon cut the cables which held them to the heavy Raft...

On the first night, several people lost their lives through having their lower bodies entangled in the interstices in the planks between the raft. On the next, many of the soldiers, who had been drinking, mutinied against their officers, leading to a battle where sixty-five men died. The next day, some of the survivors began to practise cannibalism, which eventually all engaged in by the fourth day. By the sixth day, twenty-eight survivors remained, but only fifteen seemed healthy enough to hold out for longer. A council was held and the decision was made to throw these sick into the sea, to sustain the rest for another six days. These fifteen managed to suffer through another seven days, until 17 July, when the Argus, part of the Medusa’s original convoy, rescued them. The Argus had disappeared after its initial sighting by the men on the raft, leading them to abandon hope. Two hours later, however, it returned. Five of the survivors died shortly after reaching land. The raft’s voyage had lasted thirteen days and taken one hundred and forty lives.
Compatibility before Commitment: Do Couples Consider Compatibility before Marriage?

Emma Best-Prothero

Abstract

A major feature of intimate relationships is compatibility. It can be the catalyst for an intimate relationship, while incompatibility can hasten the termination of an intimate relationship. In 2011 a law firm in the United Kingdom released a list of questions which they recommended all couples address, to evaluate their compatibility prior to committing to each other. This recommendation infers that compatibility is static and cannot develop, as well as that a formalised discussion is the best manner in which to consider compatibility. This research project will explore the need to consider compatibility prior to commitment by addressing the research question: ‘do couples consider compatibility prior to committing to marriage?’ Utilizing a series of semi-structured, in-depth interviews with four couples who recently married, this research project concludes that compatibility within an intimate relationship is highly desirable, and is considered before committing to marriage. Indeed, individuals test and sample compatibility by cohabiting prior to commitment. At the same time, cohabitation strengthens and enhances compatibility.

Introduction

Compatibility is a major feature of intimate relationships. In the first days of dating compatibility can aid in ensuring the continuance of the relationship, while incompatibility can expedite a decision to end the relationship. In the later stages of a relationship, compatibility is valuable in aiding conflict resolution (Crawford, et al., 2002). The Oxford English Dictionary defines compatibility as the capacity for two things to exist or occur together without problems or conflict (Compatibility, 2011). Within an intimate relationship text books commonly refer to compatibility as the ability of two individuals to harmoniously exist within the relationship (Lindsay & Dempsey, 2009).
There are multiple sociological implications of compatibility, including: a) the role of compatibility within intimate relationships and how it is being capitalised, b) the value placed on compatibility and areas in which an individual wishes to be compatible with another, and finally c) the increasing number of individuals choosing to cohabit before, or in place of, marrying. Research has highlighted the potential for compatibility to be a catalyst to a relationship, and how this is being capitalised on within society (Lindsay & Dempsey, 2009).

Individuals are often introduced to another because a mutual friend perceived them to be compatible, in hope they will ‘hit it off’ (Glick, DeMorest, & Hotze, 1988). Compatibility has been capitalised through online information and communication technologies, particularly personality-matching dating websites, where individuals are matched based on compatibility of personality (Barraket & Henry-Waring, 2008). Moreover, recent research has proposed a change in the value placed on compatibility, as well as ways in which individuals wish to be compatible. A 2004 study revealed approximately 30% of participants felt they were very selective when it came to choosing a partner, desiring a highly compatible partner, rather than committing to a relationship for the sake of it (Qu, & Soriano, 2004). Furthermore, Hughes (2005) has proposed the way in which individuals wish to be compatible with another may be influenced by the changing dynamics of modern relationships. Hughes noted within ‘Generation X’, those born between 1965-1979, the ideas of gender roles, obligation and duty have been replaced with ideas of self-actualisation, of individuals as self aware autonomous beings, of contingency, and individualism. Thus, individuals may consider their compatibility with another more in terms of self-improvement, career ambitions, and individualism. Finally, much has been made of the relatively new norm of unmarried cohabitation; which is common in all age groups, but particularly amongst individuals in their 20s (Lindsay & Dempsey, 2009). In 2006, 21% of men and women were in cohabiting relationships (Heard, 2008). It is feasible cohabiting affords couples the chance to test and determine the compatibility of a long term relationship without formally committing to each other.

At the same time research on compatibility has found incompatibility to be the second most cited reason for divorce, after infidelity (Amato & Previti, 2003). Interestingly, it was within the context of incompatibility leading to divorce that Bross Bennett, a law firm in the United Kingdom released a list of questions they recommended all couples address prior to committing to each other. Presumably, they released the questions to highlight their understanding of the role of incompatibility in divorce, while promoting their services as divorce law experts. Within the press release Ruth Bross, a partner at the firm, equated committing to another person with hiring a new employee:
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No employer would offer someone a job without considering their suitability for that position and neither should a couple embark on a lifelong commitment without doing their research (Bross Bennett LLP, 2011).

By comparing committing oneself to another within an intimate relationship, to a job interview, Bross seemingly overlooks the emotions associated with relationships. Indeed, the list of questions, titled the ‘Bross Bennett Compatibility Quiz’ (BBCQ) (enclosed as Index I), reads like a list of questions asked of a potential employee, not a potential intimate partner. Additionally, the formalised recommendation from Bross Bennett infers that individuals are not considering compatibility before committing to marriage, and frames compatibility as static with no ability to develop during an intimate relationship.

Overlooking the blatant mistake of removing emotions from the emotionally heavy area of intimate relationships, the suggestion that individuals should, but do not, consider compatibility before marriage is worthy of exploration. The objective of the current study is to investigate whether couples do consider compatibility before marriage, and if so, how?

**Methodology**

As the aim of this research is to investigate whether couples consider their compatibility before committing to marriage, data was collected through conducting semi-structured, in-depth interviews with couples who had recently (within 18 months) married.

This research method was chosen due to the ability of interviews to elicit nuanced and detailed accounts of individual experiences, opinions and feelings – in particular to address sensitive topics, such as whether individuals within the intimate relationship considered compatibility prior to marriage (Gorden, 1980). Furthermore, the in-depth interview aims to answer social questions through the understanding people bring to their interpretation of the social world (Travers, 2010). The semi-structured interview encourages participants to discuss their experiences, feelings and opinions through open-ended questions, with the ordering of future questions determined by the interviewee’s response (Dearnley, 2005).

Four couples who were known to the researcher, and who had married within the 16 months prior to the interview, were interviewed. For the purposes of this research the couples will be identified with the pseudonyms Mr. and Mrs. Boulevard, Mr. and Mrs. Island, Mr. and Mrs. Maxwell and Mr. Avant and Ms. Becket. All four couples are in their mid to late twenties, living in Canberra, had
cohabited for at least a year prior to marriage, and did not have children. At the time of the interview, at least one member of each couple worked within the Australian Public Service, and one or more individuals in each relationship had studied as well as worked full-time in the previous year.

All interviewees knew the researcher, though some relationships were dependent on the second partner. The partner who did not know the researcher independently, may have felt uncomfortable being interviewed alone. Although more results may have been produced by interviewing each partner individually and then as a couple, couples were interviewed together.

The four interviews were conducted at the interviewees’ home over coffee and biscuits in their primary living area. This was done to maximise participant comfort and decrease participant anxiety. Moreover, in three of the four interviews, the interviewees’ dog was also located in the primary living room for beneficence.

At the commencement of the interview, the researcher provided each participant with a copy of the BBCQ for reference and an overview of the research, including the purpose of the interview, the objectives of the research, an explanation of how the data collected would be used, the voluntary nature of participation, and how confidentiality would be assured. The researcher requested consent from the interviewees’ to record the interview, and took the time to address any points of interest or questions raised by the interviewees. At this time, the researcher explained the concept of the BBCQ, and commenced the interview, asking the interviewees’ a number of questions regarding their beliefs on compatibility, including their thoughts of the BBCQ and whether they considered their own compatibility before committing to marriage.

**Discussing Compatibility**

When asked to define compatibility each couple interviewed, identified compatibility differently; though all noted that being compatible did not mean agreeing all of the time. Indeed most listed having differences as a positive element of compatibility. Ms. Becket added that she believed compatibility embodied respect and compromise:

I don’t think it’s necessarily about wanting to do all the same things all the time together, and having the same views, it’s more about being able to respect each other’s views and if you disagree so be it, and if you need to find a compromise, you both find a compromise.

Mr. Island suggested that compatibility was a balance of being alike and unlike:
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I guess it’s having enough in common to be able to do things together without fighting, and enough that is unique to find each other interesting and maintain your own individuality. I think if you were too similar you would spend all your time together and it would suck. And if you were too different you wouldn’t be able to agree on anything and there would be constant conflict. So I think compatibility falls somewhere between being the same and being different.

Using their definition of compatibility, all couples believed they were compatible. When questioned on the specific characteristics of compatibility, a number of traits not normally considered in a dictionary definition were listed, including: respect, awareness, acceptance, compromise, patience, and support. The common characteristic listed by all participants, however, was individual identity – desired in both a partner and oneself.

We have always believed it’s important to spend time apart and with other people, and it’s important to have your own interests.

The fact that maintaining individuality was consistently listed as a compatibility trait supports Hughes (2005) finding on the importance of individuality for ‘Generation X’.

Additionally, all participants said they felt knowing whether they are compatible with their partner was important to them, with each individual in the partnership considering their compatibility prior to committing to marriage, or prior to getting engaged. It was the experience of participants that compatibility could be discussed, analysed and determined organically in the relationship, without necessarily utilising a tool such as the BBCQ. Mrs. Boulevard said:

I think it would be important for people to have a vague idea of their partner’s idea, and whether they are compatible on things, rather than blindly going into it. Knowing three people my age who are now divorced, I think there were things they could have picked up on earlier.

The importance of having an understanding of the compatibility within their relationship was expressed by all, with most couples suggesting it was beneficial to the investment (emotional, physical and financial) they were making within their relationship.

I think that people should consider it, because [on] a lot of these things, if your answers are different and you don’t have a good way of dealing with it, they can be marriage breakers!

These references to divorce and ‘marriage breakers’ due to incompatibility, support the importance of considering compatibility prior to marriage, while highlighting the role of incompatibility within divorce.
Another theme captured within all four interviews was the development of compatibility. All four couples were able to list at least one area where they felt they had become more compatible over time. Mr. Avant and Ms. Becket found they had become more compatible in leisure activities, through encouraging one another to try new activities. Mr. and Mrs. Island mentioned numerous times that they were able to track the development of their compatibility through their approaches to joint finances. They explained their compatibility had strengthened due to understanding each other's needs and expectations regarding finances and implementing systems that worked for both. Mr. and Mrs. Boulevard felt that their attitudes towards housework had become more compatible, putting the increased compatibility down to living together and understanding their partner in regards to how they had been raised by their parents and the roles they had seen their parents play. Mr. and Mrs. Maxwell noted they had become more compatible regarding family ties, with Mrs. Maxwell compromising with respect to the time spent with her immediate family.

I am trying to think of something, I guess in terms of the family stuff... well, we don’t go every Sunday, we go sometimes, and other times I go by myself, so I guess that's give and take, it's just a compromise, everything is about a compromise.

Indeed, Mr. and Mrs. Boulevard, and Mr. Avant and Ms. Becket both suggested that living together prior to committing to each other in marriage had allowed them to explore and sample their compatibility, which may have helped them understand it better, and enable its development.

I think, in [the] modern day, because we lived together for 5 years before even getting engaged, you tend to figure out if you are compatible by that point or not anyway. So I guess it would be different, I guess using the job interview (analogy used in BBCQ), you could look at it as a 5 year long job interview before you have gotten married as opposed to sitting down with six questions on day three and answering the questions together.... I think the more you live with someone, the more alike you become and the more your values align. Just from sheer interaction with that person.

We have been together for six years, almost six years before we got married, so I think they (issues of compatibility) were all ironed out beforehand.

The demonstration of the development of capability during an intimate relationship is significant to this research as well as future research on compatibility and cohabiting.
Conclusion

This research explored compatibility within a committed intimate relationship by addressing the question: ‘do couples consider compatibility before committing to marriage?’ The findings of this research suggest that couples do evaluate compatibility before marrying, with compatibility within an intimate relationships being highly desirable. Couples believe it is necessary and beneficial to assess compatibility prior to marrying, as the failure to do so could lead to ‘marriage breakers’ or ‘nasty surprises’. Moreover, evaluating compatibility also enables the development of conflict resolution within an intimate relationship. Finally, cohabiting prior to marriage allows for compatibility to be tested and sampled by both partners, and also facilitates the enhancement of compatibility.

The development of compatibility throughout an intimate relationship is sociologically relevant given the rising rates of divorce and the decreasing number of couples choosing to marry, and as such, should be central to future research. As the findings of this research cannot be generalised due to the small sample size and recruitment method, future research should first verify the results by replicating the present research with a larger random sample. The present research should then be expanded on to examine how and why compatibility develops over time. It is feasible that time spent together, shared experiences and/or joint emotional investments enhance compatibility within an intimate relationship. It is also equally plausible that a couple’s incompatibility increases over time due to the same reasons.
Index I – Bross Bennett Compatibility Quiz (BBCQ)

Finance

1. Do you know the extent of each other's assets?
2. How do you both view the sharing of these assets?
3. Do you have the same attitude to saving?
4. Will one of you want to put into a pension what the other wants to put into a new car?
5. Will you pool your resources or do you want to keep everything separate?
6. Joint accounts or separate?
7. Will you contribute in proportion to your incomes, or equally?
8. Are you going to have to pay off your partner's debts perhaps from what you thought was going to be the deposit on your house?

Family Ties

1. What sort of relationship do you have with your extended family?
2. Are they good at staying in touch?
3. Are they local?
4. Affectionate?
5. Over-involved?
6. Have you had any major fellings out?

Children

1. Do you want children?
2. How many?
3. How do you want to raise your children?
4. What sort of values do you want to pass on?
5. Do you have opposing views about the benefits of state versus private education and should you be thinking now about buying in a catchment area for a good state school?
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Religion

1. What are your religious views?
2. Do you agree on what religion you will bring up the children in?
3. Church/mosque/synagogue?
4. Once a week or once a year? Or no religion at all.

Leisure and fun

1. Do you like doing the same things in your spare time?
2. Do you share common interests?
3. Is your idea of a holiday lying flat on the beach for two weeks and your partner's rock-climbing?

Lifestyle

1. What sort of lifestyle are you aiming for?
2. Where do you want to live?
3. Do either of you have a dream of downsizing at some point and living away from the city?

Spending

1. Do you have an expensive shoe or gadget habit?
2. Does one of you think of a particular purchase as an essential that the other regards as a "discretionary spend"?
3. Do you have any other secret addictions: handbags, chocolate, football?
4. Do you gamble, online or otherwise?
Work

1. Are your respective career paths compatible; is either of you going to have to make compromises?
2. Are you prepared to?
3. Will you want to give up work when you have children?
4. What does your partner think about this and can you manage financially?
5. What about part-time working?

Roles: Traditional or Modern?

1. Will you expect to live along traditional lines: woman as homemaker and man as breadwinner?
2. Who will organize the finances?
3. Will household responsibilities be shared equally?
4. Who will assume responsibility for paying bills?

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Abstract

Computational and experimental research has shown that small multiply bonded molecules can be activated and cleaved by three coordinate transition metal complexes. The activation and selective cleavage of bonds in SCO was investigated in this study by computational methods using Density Functional Theory. Metal amide complexes (ML₃, where M=Mo, Re, Ta, and L=NH₂) were used in combinations of Mo/Mo, Re/Ta, and Ta/Ta in order to investigate the possibility of achieving selective cleavage of SCO. For the Mo/Mo and Ta/Ta systems, the cleavage step for either system was not found to be favourable on the basis of enthalpy considerations, but was calculated to be favourable if entropy effects were included, on the basis of the resulting free energy reaction profile. Different selectivity was observed for each system, with S-C scission favoured for the Mo/Mo case, and C-O scission favoured for the Ta/Ta case. In the Re/Ta system, cleavage of the SCO molecule is thermodynamically favourable, but no selectivity is observed. However, given that no barrier was found for cleavage of the S-C bond, in contrast to the observation of a relatively small barrier for cleavage of the C-O bond, it is inferred that S-C scission may be favoured on mechanistic grounds.

1. Introduction

Interest in small molecule activation initially comes from the necessity of achieving cleavage of the N-N triple bond for nitrogen fixation. N₂ is converted to ammonia by breaking this bond; industrially this is currently achieved by using temperatures of approximately 500K and pressures around 500atm in the Bosch-Haber Process [1]. Very large amounts of energy are used during the Bosch-Haber Process in order to produce ammonia from atmospheric N₂, which is an important material used for production of fertilisers and explosives [1, 2].

Other methods to achieve the fixation of N₂ under milder conditions have been investigated. Some methods involve using transition metal complexes to lower the activation energy of the reaction. This is achieved by binding a metal to
N₂ which then weakens and activates the bond between the nitrogen atoms by some amount depending on the metal and ligands used in the complex. Laplaza and Cummins, in 1995, were able to synthesise a three coordinate Molybdenum complex, Mo(NRAr)₃, where R is C(CD₃)₂CH₃ and Ar is 3,5-C₆H₃(CH₃)₂, stabilised by the steric bulk of its ligands, which was then able to cause scission of the N-N triple bond under mild conditions [3]. Since then interest in using transition metal complexes to activate small molecules such as N₂ has grown, and this problem has been widely investigated using computational methods as well [2].

The activation of diatomic small molecules with strong multiple bonds, such as N₂, NO, CN⁻ and CO, using transition metal complexes, has been investigated in previous studies utilising the Density Functional Theory [4-9]. Density Functional Theory is a quantum mechanical modelling method which is commonly used in chemistry and physics to investigate electronic structure and properties of systems of atoms and molecules. This relies on using functionals of electron density to simplify calculations that involve many electrons.

The factor that drives the reaction has been hypothesised to be the stability of the product metal complexes relative to the reactants. This stability is derived from the strength of the bond of the metal to the fragment atom from the small molecule [7]. It has been shown that the extent of activation of the small molecule bond is increased for heavier elements within a group and earlier elements within a period, as the heavier and earlier transition metals form stronger bonds to fragment atoms such as C, N, and O, due to the combination of more dilated d orbitals and more favourable energy match between energy levels [7].

The activation and cleavage of the bond in the N₂ molecule is achieved through back donation of electrons to the π* orbital [8]. In order to accomplish this, the metal must have the appropriate d orbital configuration and be able to bind strongly to the molecule [8, 9]. A small molecule that is a greater π acceptor is more easily cleaved. The choice of ligands is also important in achieving transfer of electron density to the small molecule [4].

Experimental ligands are too big for calculations used in studies of this kind and therefore, ligands such as NH₂ and OH have to be used. While these do not reproduce steric effects of the experimental ligands, they do have the appropriate similar electronic effects which are more significant in causing activation and cleavage of the small molecule bond [4], and allow calculations to become far less computationally demanding.

After in depth study of the activation of many strong multiply bonded diatomic molecules, attention has turned to the activation and cleavage of a variety of triatomic molecules, such as N₂O [10] and CS₂ [11]. In the case of N₂O, a MoL₃ complex binding to both ends of the molecule was able to cause scission of the
Selective Cleavage of SCO by Transition Metal Complexes

N-N bond without breaking the N-O bond, the weaker of the two bonds in the molecule. Selectivity of cleavage was then reversed by using MoL₃ binding to the N-N end and NbL₃ binding to the N-O end. These results were computationally rationalised on the basis of the stability of the products produced [12].

The purpose of this study was to extend the investigations on the selective cleavage of unsymmetric triatomic molecules by focusing on carbonyl sulphide, SCO. While SCO does not have as large industrial significance as N₂ it is an important molecule to study because there has been relatively little computational work done on the selective cleavage of unsymmetric triatomic molecules. This investigation also focused on whether it is possible to achieve selective cleavage of the C-O bond instead of the significantly weaker S-C bond, which is an important result. As it is similar to CS₂, an analogous approach was used in order to investigate selective cleavage of the S-C and C-O bonds in SCO [11].

2. Computational Details

Two main methods are used in computational chemistry to perform calculations: methods involving electron density such as the Density Functional Theory and methods that involve wave functions, such as Hartree–Fock and electron correlation approaches. In the latter the calculations become much longer and more complicated if they involve atoms with large numbers of electrons, such as calculations involving transition metals, so in this investigation Density Functional approaches were used [13].

All density functional calculations were carried out using the Amsterdam Density Functional (ADF 2010) package [14-16]. A Generalized Gradient Approximation (GGA) functional consisting of the exchange and correlation expressions proposed by Becke [17] and Perdew [18] respectively, was utilised. Basis sets of the all-electron type and triple-zeta quality - including one polarization function (TZP) - were employed [14-16].

As the non-relativistic Schrodinger Wave equation does not accurately describe heavy atoms, in which relativistic effects become important for electrons close to the nucleus, these effects were taken into account by using the Zero Order Regular Approximation (ZORA) [19-21].

The calculations were performed under solvation effects incorporated by using the Conductor-like Screening Model (COSMO) [22], with toluene as the solvent. This model allows calculations to more accurately represent the experimental systems.
Calculations were performed in a spin-unrestricted manner using default convergence parameters, whose values are $10^{-3}$ hartree for energy, $10^{-3}$ hartree/angstrom for gradients, and 4.0 for the integration accuracy.

### 2.1. Bonding Energy Analysis

Bonding interactions were investigated by means of an energy decomposition analysis [23, 24] that employs a fragment approach to the molecular structure of a chemical system. In this approach, the decomposition of the total bonding energy ($E_b$) is given as,

$$E_b = E_e + E_p + E_o \quad (1)$$

where $E_e$, $E_p$, and $E_o$ are, respectively, the electrostatic interaction, Pauli repulsion, and orbital interaction terms. A detailed description of the physical significance of these terms has been given by Bickelhaupt and Baerends [25].

The bonding energy ($E_b$) can be considered a measure of the instantaneous interactions between the fragments in the molecule, but does not represent the bond dissociation energy ($E_d$) which is defined as,

$$E_d = E_b + E_f \quad (2)$$

and contains, in addition to the bonding energy, a contribution ($E_f$) arising from the fragment preparation process. This process can be described as the energy associated with the transformation of the fragments from their equilibrium geometric and electronic states into their “intrinsic” geometric and electronic states in the molecule.

The electrostatic ($E_e$) term is calculated from the superposition of the unperturbed fragment densities at the molecular geometry, and corresponds to the classical electrostatic effects associated with coulombic attraction and repulsion. The electrostatic contribution is generally dominated by the nucleus-electron attractions and therefore has a stabilizing influence. The Pauli ($E_p$) term arises from the requirement that electronic antisymmetry conditions be satisfied and is associated with repulsive four-electron two-orbital interactions and therefore has a destabilizing effect. The orbital interaction ($E_o$) term represents a stabilizing factor originating from the relaxation of the molecular system due to the mixing of occupied and unoccupied orbitals, and can involve electron-pair bonding, charge-transfer or donor-acceptor interactions, and polarization.
3. Results and Discussion

3.1. SCO Molecule

The geometry of the SCO molecule was calculated and is given in Figure 1 and Table 1 below. The frequencies of the molecule were also calculated and are displayed in Table 2.

![Structure of the SCO molecule: S (left), C (middle) and O (right).](image)

**Table 1: Comparison of Geometric Parameters for the SCO molecule. Calculated in the Gas Phase, Solvent Phase and Experimentally Determined.**

<table>
<thead>
<tr>
<th>Bond Length (pm)</th>
<th>S-C</th>
<th>C-O</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas Phase</td>
<td>157</td>
<td>117</td>
</tr>
<tr>
<td>Solvent Phase</td>
<td>157</td>
<td>117</td>
</tr>
<tr>
<td>Experimental [26,27]</td>
<td>156</td>
<td>116</td>
</tr>
</tbody>
</table>

**Table 2: Comparison of Vibrational Frequency results for the SCO molecule. Calculated in the Gas Phase, Solvent Phase and Experimentally Determined.**

<table>
<thead>
<tr>
<th>Frequency (cm⁻¹)</th>
<th>Gas Phase</th>
<th>Solvent Phase</th>
<th>Experimental [28]</th>
</tr>
</thead>
<tbody>
<tr>
<td>2033</td>
<td>1996</td>
<td>2062</td>
<td></td>
</tr>
<tr>
<td>855</td>
<td>853</td>
<td>859</td>
<td></td>
</tr>
<tr>
<td>498</td>
<td>493</td>
<td>521</td>
<td></td>
</tr>
</tbody>
</table>

As can be seen in Figure 1 and Table 1, the experimental geometry of SCO matches very closely to the calculated geometry in both the gas and solvent phases. The frequencies calculated for the SCO are overall in reasonable agreement with those determined experimentally. The bond strength of the S-C and C-O bonds were also calculated in the solvent phase to be 366 kJ/mol for S-C and 752 kJ/mol for the C-O bond, with a difference of 386 kJ/mol. The experimentally determined bond strengths are given as 305 kJ/mol for S-C and 668 kJ/mol for C-O [29]. While individual bond strengths do not match well with those...
calculated, the difference between the experimental bond strengths, 363 kJ/mol is close to the difference in calculated bond strengths. The molecular orbitals of SCO were also calculated and are given in Figure 2 below.

Figure 2: Calculated Molecular Orbitals for SCO: S (left), C (middle) and O (right). Energy of each orbital is given relative to the LUMO.

Based on the character of the HOMO and LUMO it can be seen that the sulphur end of the molecule should be more reactive than the oxygen end. The lowest unoccupied molecular orbital is observed to have a π antibonding character, so by introducing electrons to this orbital from the metal atoms the bonds in the molecule should be weakened significantly.
3.2. Reaction Energetics

The mechanism for the cleavage reaction of SCO is based on previous studies, in particular the investigation of bond scission in N₂O [10] and CS₂ [11]. The reaction is as follows:

Reactants → Encounter Complex → Dinuclear Species → Products

The structures of the reactants and products involved in the reaction are well established from previous investigations [4-11]. Several structures for the encounter complex and dinuclear species were investigated for each system.

Based on the experimental systems involving molybdenum complexes used in other studies, Mo(NH₂)₃ complexes were used in initial calculations investigating activation and cleavage of SCO. The thermodynamic profile for the Mo/Mo system is shown in Figure 3 and the results from a calculation of the barrier to S-C scission are shown in Figure 4.

![Figure 3: Energy profile for the Mo/Mo system including the structures of the encounter complex and dinuclear species.](image)

1=H, 2=N, 3=Mo, 4=O, 5=C and 6=S.
It is clear from this profile that the cleavage of either bond is thermodynamically unfavourable. The cleavage of the S-C bond is however significantly more favourable than cleavage of the C-O bond, preferred by 45 kJ/mol.

The selectivity of SCO bond cleavage can be rationalised on the basis of the competing effects of product stability and reactant bond strength. The total bonding energy of the products formed from C-O scission is more favourable (Table 3) as Mo forms a particularly strong bond with the O fragment. However, this overall difference in product stability is not sufficient to compensate for the much larger dissociation energy of the C-O relative to S-C bonds, and S-C scission is thus energetically more facile.

**Table 3: Bonding energy of respective products from cleavage of SCO in the Mo/Mo system.**

<table>
<thead>
<tr>
<th>Intrinsic Bonding Energy of Products (kJ/mol)</th>
<th>Total (kJ/mol)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mo-CS</td>
<td>O-Mo</td>
</tr>
<tr>
<td>-530</td>
<td>-727</td>
</tr>
<tr>
<td>Mo-CO</td>
<td>S-Mo</td>
</tr>
<tr>
<td>-390</td>
<td>-515</td>
</tr>
</tbody>
</table>
Two particularly significant molecular orbitals of the products are shown in Figure 5.

![Figure 5: Calculated HOMO for L₃Mo-CO produced by cleavage of S-C and C-O bonds. (a) Calculated HOMO for L₃Mo-CO, produced by cleavage of S-C bond. (b) Calculated HOMO for L₃Mo-O, produced by cleavage of C-O bond. Where 1=L=NH₂, 2=Mo, 3=C, 4=O (largely similar properties are found for L₃Mo-CS, and L₃Mo-S).](image)

Some unfavourable orbital occupancy patterns result from the use of Mo atoms with a formal d³ configuration, namely, the HOMO of L₃Mo-CO and L₃Mo-CS contains 3 instead of 4 electrons, thereby reducing the bonding character of this interaction, whereas in L₃Mo-O and L₃Mo-S, an antibonding orbital is occupied leading to additional destabilization of the products. These observations are consistent with the predicted unfavourable character of the S-C or C-O cleavage steps.

Following this result, a system using Rhenium and Tantalum complexes was predicted to lead to more favourable thermodynamic properties for the cleavage step, as these metals would stabilise the products of S-C and C-O bond scission. This is due to the d⁴ electron configuration of the Re atom, which fully occupies the bonding orbital when binding to CS or CO, and the d² electron configuration of the Ta atom, which avoids occupation of the antibonding orbital when binding to O or S. The use of the heavier Re and Ta atoms, which should form stronger bonds than their lighter counterparts in the 4d transition series, should also contribute to increasing the thermodynamic driving force for the cleavage step.

The energy profile for the Re/Ta system is given in Figure 6 and the calculation results of energy barriers for the cleavage of the S-C and C-O bonds are given in Figure 7.
Figure 6: Energy profile for the Re/Ta system. This includes the structure of the encounter complex and dinuclear species. 1=H, 2=N, 3=Re, 4=O, 5=C, 6=S and 7=Ta.

From the energy profile in Figure 6, cleavage of the C-O bond is energetically favourable by 101 kJ/mol and cleavage of the S-C bond is favourable by 100 kJ/mol, therefore, no selectivity is predicted on the basis of reaction thermochemistry. However, there is a barrier of 27 kJ/mol for the cleavage of the C-O bond, and no such barrier exists for the cleavage of the S-C bond. This suggests that while each set of products may be similar in energy, the S-C scission is likely to be preferred as this will take place spontaneously.

The failure to observe bond cleavage selectivity was confirmed by an analysis of the bonding energy of the respective products S-C and C-O scission (Table 4).

Table 4: Bonding energy of respective products from cleavage of SCO in the Re/Ta system.

<table>
<thead>
<tr>
<th>Intrinsic Bond Energy of Products (kJ/mol)</th>
<th>Total (kJ/mol)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Re-CS</td>
<td>O-Ta</td>
</tr>
<tr>
<td>-693</td>
<td>-1008</td>
</tr>
<tr>
<td>Re-CO</td>
<td>S-Ta</td>
</tr>
<tr>
<td>-561</td>
<td>-752</td>
</tr>
</tbody>
</table>
Figure 7: Energy barrier calculations for Re/Ta system. (a) cleavage of the S-C bond, and (b) cleavage of the C-O bond, including transition state structure. Where 1=H, 2=N, 3=Re, 4=O, 5=C, 6=S and 7=Ta.
Based on the bonding energy of the products, it can be seen that cleavage of the C-O bond is favoured, thermodynamically driven by the increased stability of the products, most notably, the large Ta-O bond strength. The stability of the products determined from bonding energy suggests cleavage of the C-O bond, however the energy required to break that bond counteracts the extra stability of forming these products, and this is why there is no preference for breaking C-O based on the reaction profile (stability effect is 388 kJ/mol in favour of C-O scission products counteracted by 386 kJ/mol in favour of breaking the weaker S-C bond).

Based on the bonding energy calculations for the Re/Ta system, a Ta/Ta system was also investigated in order to explore the possibility of achieving selective cleavage of the C-O bond.

The Ta/Ta system would be better to use from an experimental perspective as it can more accurately model a possible experimental system, as Tantalum is more viable to use than Rhenium, and has in fact been used in previous studies [30].

The other experimental advantage that Ta/Ta would have is that only one metal is being used and there does not need to be as much consideration into the formation of the encounter complex.

The energy profile for the Ta/Ta system is given in Figure 8.

![Figure 8: Energy profile for the Ta/Ta system. This includes structures of the encounter complex and dinuclear species. 1=H, 2=N, 3=Ta, 4=O, 5=C and 6=S.](image)
Figure 8 shows that cleavage of the C-O bond is preferred over cleavage of the S-C bond by 16 kJ/mol, although the process is still unfavourable based on the stability of the dinuclear species relative to products. Barrier and transition states for the breaking of the C-O bond could not be obtained for the Ta/Ta system due to severe convergence issues.

The effects of entropy in the cleavage step of the reaction were estimated for each system. It is expected that these effects can be significant, as the cleavage step involves going from a single molecule system to a two molecule system, which leads to an increase in entropy in the cleavage step of the reaction. The enthalpy and free energy of the cleavage step for each system are given in Table 5.

Table 5: Enthalpy and free energy for the cleavage step of Mo/Mo, Re/Ta, and Ta/Ta systems.

<table>
<thead>
<tr>
<th>System</th>
<th>Products</th>
<th>ΔE (kJ/mol) – including Zero Point Correction</th>
<th>ΔG (kJ/mol)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mo/Mo</td>
<td>Mo-CS + O-Mo</td>
<td>7</td>
<td>-48</td>
</tr>
<tr>
<td></td>
<td>Mo-CO + S-Mo</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Re/Ta</td>
<td>Re-CS + O-Ta</td>
<td>-106</td>
<td>-164</td>
</tr>
<tr>
<td></td>
<td>Re-CO + S-Ta</td>
<td>-102</td>
<td>-167</td>
</tr>
<tr>
<td>Ta/Ta</td>
<td>Ta-CS + O-Ta</td>
<td>12</td>
<td>-49</td>
</tr>
<tr>
<td></td>
<td>Ta-CO + S-Ta</td>
<td>28</td>
<td>-37</td>
</tr>
</tbody>
</table>

It is clear from Table 5 that cleavage of the dinuclear species to form the products is favourable for the Mo/Mo and Ta/Ta systems when entropic effects are taken into consideration and selectivity is displayed in both of these systems. Mo/Mo shows a preference of 41 kJ/mol for S-C breaking, and Ta/Ta has the opposite selectivity, with cleavage of C-O bond favoured by 12 kJ/mol. The cleavage of SCO by the Re/Ta system is favourable on the basis of both enthalpy and free energy results, but there is no clear selectivity for this system.

4. Conclusion

The selective cleavage of the SCO molecule by three coordinate transition metal complexes was investigated computationally using Density Functional Theory methods. Three systems were studied, Mo/Mo, Ta/Ta and Re/Ta.

Based on electronic structure considerations, the Re/Ta system was expected to lead to the most favourable overall results, and although it did produce the most thermodynamically favoured cleavage of SCO, there was no clear selectivity for S-C or C-O bond scission. However, cleavage of S-C bond may be preferably observed on the basis that the S-C scission step is predicted to occur spontaneously, whereas a barrier to C-O scission does appear to exist.
Cleavage of SCO in both the Mo/Mo and Ta/Ta systems was found to be unfavourable on the basis of initial enthalpy results, but subsequent inclusion of entropy effects indicates that the bond scission step should be favoured by overall free energy change. Cleavage can in principle be selectively achieved using these two complexes. Mo/Mo selectively cleaved the S-C bond, preferred by 41 kJ/mol, and Ta/Ta selectively cleaved the C-O bond, which was favoured by 12 kJ/mol.

5. Related Issues and Future Work

It is always important to consider the possible uncertainties in any experiment, however calculations performed using the Amsterdam Density Functional package do not provide such information. It is still believed that the results obtained from these calculations are accurate and reliable, in particular that the differences in energy between sets of products are large compared to the possible uncertainties.

While the choice to use NH$_2$ ligands in this study was made to reduce computational time and gain a general understanding of the mechanism of the selective cleavage of SCO, the simplicity of using this model does have some drawbacks. In particular the choice of such simple ligands does not take into account steric factors that play an important role in the real system. The NH$_2$ ligands are also free to rotate; this is not possible in the real system, which uses much larger ligands. This study has provided a basis for further work on the selective cleavage of SCO by transition metal complexes, which will involve more realistic ligand sets.

References


Selective Cleavage of SCO by Transition Metal Complexes


Terrorists, Freedom Fighters and Refugees: Non-Political Crimes in Article 1F(b) of the Refugee Convention

Jasmine Still

This essay deals with the topical issue of the circumstances under which criminals can be refugees. Article 1F(b) of the Convention Relating to the Status of Refugees (the Refugee Convention) denies refugee status to people who have “committed a serious non-political crime”. Thus, if a person has committed a serious crime that was political in nature it does not preclude them from enjoying the benefits of refugee status.

There are many competing interpretations of ‘non-political’, including the predominance test, which is the approach adopted by the United Nations High Commissioner for Refugees. This test states that a crime will be political if a political purpose is the predominant characteristic of the crime.

This essay assesses the predominance test against the rules for treaty interpretation set out in Article 31 of the Vienna Convention on the Law of Treaties. This involves examining whether this interpretation is in good faith and accords with the ordinary meaning, context and object and purpose of Article 1F(b) of the Refugee Convention.

This essay concludes that the predominance test is a highly appropriate interpretation of Article 1F(b). In the interests of consistency it should therefore be adopted by all the parties to the Refugee Convention.

A. Introduction

1. The Importance of Article 1F(b)

Article 1F(b) of the Convention Relating to the Status of Refugees (Refugee Convention) denies the benefits of refugee status to a person when there are serious reasons for considering that “he has committed a serious non-political crime outside the country of refuge prior to his admission to that country as a
refugee”,\(^1\) even if he has a “well-founded fear of being persecuted for reasons of race, religion, nationality, membership of a particular social group or political opinion”.\(^2\) As such, it can have devastating consequences because it places the person at risk of being returned to face persecution in their state of origin.\(^3\) Furthermore, with the increase in violent conflicts involving breaches of human rights and deliberate attacks on civilians, more and more people are potentially falling within its scope.\(^4\) Thus, as Article 1F(b) is increasingly relevant to refugee status determinations, it is vital to know what this exclusion clause means to ensure that refugee status determinations are fair and consistent between countries.\(^5\) Unfortunately, despite this exclusion clause’s brevity and ostensible simplicity, there are many controversies about how to interpret it.\(^6\)

2. The Controversy Surrounding the Interpretation of ‘Non-Political’

One of the most intractable and complex debates is about the meaning of ‘non-political’.\(^7\) There is broad agreement that certain crimes, such as treason, are political.\(^8\) Furthermore, it is clear that crimes with purely personal motives, such as crimes of passion, are not political.\(^9\) The confusion arises over the large grey area in between these two extremes.\(^10\) For example, would targeting government supporters by placing bombs in a crowded market place be a political crime?\(^11\) What about attempting to kill the wife of a dictator?\(^12\) Making sense of these borderline cases raises fascinating treaty interpretation issues, and is

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2 Ibid, Article 1A (2).
3 UNHCR, Guidelines on International Protection No. 5: Application of the Exclusion Clauses: Article 1F of the 1951 Convention relating to the Status of Refugees, HCR/GIP/03/05 (4 September 2003), [2], [8].
6 Igor Ovcharuk v Minister of Immigration & Multicultural Affairs [1998] 1314 FCA.
increasingly important in the current climate of heightened fear of terrorism.\(^{13}\) Competing theories offer different criteria for distinguishing the political from the non-political.\(^{14}\) For example, the predominance test examines the purpose of the crime\(^{15}\) and the ‘incidence test’ focuses on determining whether the crime was part of an uprising.\(^{16}\) Alternatively, some jurists, including Justice Callinan, maintain that certain crimes, such as murder, are inherently non-political.\(^{17}\)

### 3. Aim and Approach

This essay seeks to examine the validity of the predominance test. However, as many of the different perspectives in the literature stem from different theoretical perspectives, it is important to set out this essay’s underlying assumptions. This essay approaches the issue from a positivist consent theory perspective. It assumes that international law is based on States’ consent to be bound by certain rules, for example by ratifying a treaty.\(^{18}\) The aim of treaty interpretation is therefore to determine what the Contracting States agreed to, which can be determined by examining the treaty itself.\(^{19}\) So far the jurisprudence and academic discussion on this issue has not conformed to this approach. The meaning of ‘non-political’ has largely been elaborated from the similar exclusion in the law of extradition.\(^{20}\) While the exclusion clauses in refugee law and extradition law are analogous,\(^{21}\) over-reliance on extradition jurisprudence is inadvisable for two reasons. Firstly, extradition law and refugee law are quite different.\(^{22}\) For example, extradition law is concerned with whether to return a fugitive to a requesting state, whereas refugee law is about granting certain persons special rights.\(^{23}\) Secondly, and more importantly, analogising with extradition law can distract jurists from their central task of examining the Refugee Convention itself. The drafters considered, but decided against, including a reference to extradition in the treaty.\(^{24}\) This suggests that they

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13 UNHCR, Background Note on the Application of the Exclusion Clauses: Article 1F of the 1951 Convention relating to the Status of Refugees (4 September 2003) [84].
14 Ibid, [41].
19 David Harris, Cases and Materials on International Law (Thomson Reuters, 7th ed, 2010), 674.
21 T v Secretary of State for the Home Department [1995] 2 All ER 1042.
wanted Article 1F(b) to develop independently of extradition law. Furthermore, as with all treaties, the most important aspect of interpretation is analysing the treaty, rather than external considerations.\(^{25}\)

This principle is enshrined in Article 31 of the *Vienna Convention on the Law of Treaties*, which is also customary international law.\(^{26}\) It states that a “treaty shall be interpreted in good faith in accordance with the ordinary meaning to be given to the terms of the treaty in their context and in the light of its object and purpose.”\(^{27}\) This essay aims to fill a void in the literature by focussing its analysis on this rule of treaty interpretation.

4. Argument and Structure

This essay argues that the predominance test accords with the requirements of Article 31. It will develop this argument by describing the predominance test and then examining whether it is a good faith interpretation of Article 1F(b) and accords with its ordinary meaning, context and object and purpose.

B. The Predominance Test

The predominance test is the interpretation favoured by United Nations High Commissioner for Refugees (UNHCR)\(^ {28}\) and certain Contracting States, such as the United Kingdom.\(^ {29}\) It involves examining whether a political purpose is the predominant characteristic of the crime.\(^ {30}\) This involves considering whether any political purpose is linked to the crime and, if so, whether the crime is disproportionate to this goal.\(^ {31}\) Other relevant factors include the target of the crime.\(^ {32}\) A crime perpetrated against armed agents of the State, such as police or soldiers, is more likely to be political than a crime committed against innocent civilians.\(^ {33}\)

For example, in *T v Secretary of State for the Home Department* a bomb attack on an airport that killed ten innocent people was not political, even though it was

\(^{25}\) Harris, above n 17, 674.
\(^{26}\) Ibid, 677.
\(^{28}\) UNHCR, *Guidelines on International Protection No. 5: Application of the Exclusion Clauses: Article 1F of the 1951 Convention relating to the Status of Refugees*, HCR/GIP/03/05 (4 September 2003), [15].
\(^{29}\) *T v Secretary of State for the Home Department* [1995] 2 All ER 1042.
\(^{30}\) UNHCR, *Background Note on the Application of the Exclusion Clauses: Article 1F of the 1951 Convention relating to the Status of Refugees* (4 September 2003), [41].
\(^{31}\) Ibid.
\(^{32}\) Ibid.
motivated by the goal of toppling the government. There was no link between the crime and this political goal because such a bombing would not help bring down the government. Furthermore, such an “atrocious act”, that targeted the public rather than State officials, was disproportionate to this goal.

C. Good Faith

The predominance test will be a good faith interpretation of the political crime exception in Article 1F (b) if it constitutes a genuine attempt to implement the treaty, rather than a smokescreen for the implementation of decision-makers’ own value judgements and political opinions. The predominance test involves setting out a clear test, with criteria to guide the exercise of the decision-makers’ discretion. It is therefore a good faith interpretation.

D. The Ordinary Meaning

1. Introduction

In order to interpret Article 1F (b) it is necessary to examine its ordinary meaning. Examining the text is crucially important because it expresses the will of the Contracting States and, in particular, how they chose to reconcile the competing objects of the Convention. However, in this case the text does not contain many clues to its meaning. The Oxford English Dictionary defines political as “[o]f, belonging to, or concerned with the form, organization and administration of a state, and with the regulation of its relations with other states.” This definition does not help distinguish between political and non-political crimes because it fails to specify what aspect of the crime, such as its motive, context or inherent nature, determines its character. The words “non-political crime” are therefore ambiguous and as such consistent with multiple different interpretations.

This section will nonetheless examine some of the key arguments for and against the predominance test being consistent with the ordinary meaning of

34 T v Secretary of State for the Home Department [1995] 2 All ER 1042.
35 Ibid.
36 Minister for Immigration and Multicultural Affairs v Singh (2002) 209 CLR 533, [117], [120] (Kirby J).
38 A v Minister for Immigration & Ethnic Affairs (1997) 190 CLR 225 (McHugh J).
the text. It argues that the predominance test’s consideration of the motive of a crime is consistent with the ordinary meaning of the word crime. However, the proportionality aspect of the predominance test is problematic because it is far more restrictive than the ordinary meaning of political. Criticisms of the predominance test’s underlying premise that it is necessary to carefully examine the individual circumstances of a crime in order to determine whether it is political are unconvincing as they rely on a misguided conception of politics that is divorced from the reality that exists in many states of origin.

2. Motive

The significance that the predominance test attributes to the motive of a crime is consistent with the ordinary meaning of the word ‘crime’. Crimes have both physical and mental elements. The mental element is crucial because without it the action is not a crime. Furthermore, different mental states are associated with different levels of moral culpability and thus change the nature of the offence and the punishment imposed. Given the central significance of a person’s mental state in defining a crime, it is logical and consistent with its ordinary meaning to also consider the perpetrator’s intentions, when judging whether a crime is political.40

3. Proportionality

In contrast, the proportionality component of the predominance test does not accord with the ordinary meaning of political. A proportionality analysis involves weighing the means used against the goal they sought to achieve.41 This implicitly involves a value judgement about the worthiness of the goal and the ‘atrocity’ of the means.42 However, the word political is neutral. It does not imply that something is ‘right’ or ‘wrong’, it merely states that it is associated with the governance of a country.43 The proportionality part of the predominance test therefore interprets the word ‘political’ in Article 1F (b) in a manner that is more restrictive than its ordinary meaning.44

40 R v Governor of Pentonville Prison; Ex parte Cheng [1973] AC 931 (Lord Diplock); Minister for Immigration and Multicultural Affairs v Singh (2002) 209 CLR 533, 122 (Kirby J).
Terrorism provides the perfect example. According to the predominance test terrorist acts will almost never be political because they are a disproportionate response to their supposed political goal.\(^{45}\) However, while there is no universally accepted definition of terrorism, a common element that consistently recurs when describing it is that it consists of “criminal acts intended or calculated to provoke a state of terror in the general public, a group of persons or particular persons for political purposes” (emphasis added).\(^{46}\) As terrorism is a tactic used to achieve political goals, and as such is widely perceived as political, it is artificial and counter-intuitive to state, as the predominance test does, that it can almost never be political.

Proponents of the predominance test propose various arguments why the proportionality aspect of the test is consistent with the ordinary meaning of political. One such argument is that using disproportionately violent means to achieve a political goal suggests that the crime was not really motivated by the political goal at all. It must have been motivated by something else.\(^{47}\) This is unconvincing because the history of human conflict demonstrates that political goals are exactly the kind of motivation that causes people to lose all inhibitions and commit horrendous acts.\(^{48}\) Another argument in defence of excluding atrocious crimes against civilians, such as terrorism, from the category of political crimes maintains that political crimes are directed against the government of a country. By contrast, indiscriminate acts of terrorism are directed against society and the people and are therefore not political.\(^{49}\) However this creates an artificial distinction. Politics and society are inherently interconnected. It is therefore perfectly possible that groups would use attacks against innocent people to achieve a political goal.\(^{50}\)

4. Inherent Meaning

While the proportionality component of the predominance test does not accord with the text of Article 1F(b), one interesting theoretical argument goes further and maintains that the entire predominance test is contrary to the ordinary meaning of political. Justice Callinan in *Minister for Immigration and Multicultural Affairs v Singh* (Singh) argued that violence is, by its very nature, non-political. In his view, politics is concerned with the rational and civilised governance of societies.\(^{51}\) Violence undermines this peaceful rationality and

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\(^{45}\) UNHCR, *Guidelines on International Protection No. 5: Application of the Exclusion Clauses: Article 1F of the 1951 Convention relating to the Status of Refugees*, HCR/GIP/03/05 (4 September 2003), [25].

\(^{46}\) GA Resolution 53/108 on Measures to Eliminate International Terrorism quoted in Feller, above n 13, 442.


\(^{48}\) *Minister for Immigration and Multicultural Affairs v Singh* (2002) 209 CLR 533, [107], [127] (Kirby J).

\(^{49}\) *Eain v Wilkes* extracted in *Gil v Canada* [1995] 1 FC 508.

\(^{50}\) GA Resolution 53/108 on Measures to Eliminate International Terrorism quoted in Feller, above n 13, 442.

therefore it can only ever be an unacceptable and abhorrent intrusion into the realm of politics. Violence destroys politics and therefore cannot itself be political.\footnote{Ibid.} Therefore crimes, such as murder and terrorism, will always be non-political and the predominance test’s examination of motivation, proportionality and other factors is redundant.\footnote{Ibid, [167] (Callinan J).}

While the crystal clear simplicity and purity of this conception of politics is alluring, Justice Kirby in that case raised convincing arguments about why it does not reflect the ordinary, and much more complicated, meaning of ‘political’. He pointed out that, while it is true that in stable liberal democracies like Australia violence is not part of our political processes, this is not a universal truth. In other countries violence is an endemic part of the political system, and may be the only way to achieve liberation from an oppressive government.\footnote{Ibid, [107], [127] (Kirby J).} In fact, one reason refugees flee to countries like Australia is because they are drawn by our radically different and peaceful political culture. Article 1F (b) is intended to be applied to people escaping countries where they have been persecuted, and which are therefore more likely to have a dysfunctional and violent political system.\footnote{Convention Relating to the Status of Refugees, opened for signature 28 July 1951, 189 UNTS 150 (entered into force 22 April 1954), Article 1A(2).} It would undermine this purpose to base our understanding of the ordinary meaning of ‘political’ on the conditions existing in the states of refuge, rather than the states of origin, where the crimes most likely occurred.\footnote{Minister for Immigration and Multicultural Affairs v Singh (2002) 209 CLR 533, [106] (Kirby J).}

Therefore, while the predominance test is generally consistent with the ordinary meaning of ‘non-political crime’, its proportionality component is not.

E. The Context

1. Introduction

It is also necessary to consider the context of the political crime exception, which includes Article 1F (b)’s reference to serious crimes and Articles 1F (a) and (c).\footnote{Vienna Convention on the Law of Treaties, opened for signature 23 May 1969, 1155 UNTS 331 (entered into force 27 January 1980), Article 31.} This section argues that, while these provisions appear to raise further arguments against the proportionality component of the predominance test, the proportionality test is in fact consistent with them.
2. Serious Crime

As stated above, Article 1F (b) excludes persons who there are serious reasons for considering have committed “a serious non-political crime” (emphasis added). Therefore, if a crime is not serious the issue of whether it is political does not arise, because it will not constitute grounds for exclusion under Article 1F (b). However the proportionality test’s examination of the consequences and means of perpetrating a crime, as well as its targets, would appear to come close to classifying crimes as non-political, merely because they are serious. This would be inappropriate because it was clearly the Contracting States’ intention that a person should not be denied refugee status because they committed a political crime, even if it was serious.58

However, in practice this problem does not arise because the threshold for ‘seriousness’ is much lower than the threshold for ‘disproportionality’. For example, any murder or robbery will be serious,59 but it will only be disproportionate if it was carried out in a way that could not be justified by the political motive.60 For instance, while attempted murder is a serious crime it would be proportionate if it were perpetrated via a targeted attack on the wife of a dictator because such an action is very likely to achieve the desired political aim of harming the dictator and it would be very unlikely to result in the deaths of innocent bystanders.61 A terrorist bombing of an airport, on the other hand would be serious and disproportionate because it unlikely to achieve actual political change and involves killing civilians.62

3. Articles 1F(a) and (c)

These provisions exclude from refugee status anyone who “has committed a crime against peace, a war crime, or a crime against humanity” or “has been guilty of acts contrary to the purposes and principles of the United Nations.” Both of these exclusions could cover horrendous acts, such as terrorism.65 As explained above, the proportionality part of the predominance test is inconsistent with the ordinary meaning of political. This would suggest that this proportionality analysis should be abandoned because such acts would nevertheless be excluded by Articles 1F (a) and (c). However, while terrorism

59 Sloan, above n 7, 241.
60 T v Secretary of State for the Home Department [1995] 2 All ER 1042.
61 United Kingdom Immigration Appeals Tribunal case Y (14847) 1997 discussed in Kapferer, above n 10, 202.
62 T v Secretary of State for the Home Department [1995] 2 All ER 1042.
64 Ibid, Article 1F(c).
65 UNHCR, Background Note on the Application of the Exclusion Clauses: Article 1F of the 1951 Convention relating to the Status of Refugees (4 September 2003), [83].
can constitute a crime against humanity and therefore be excluded under Article 1F (a), this involves the terrorism being part of coordinated attack on the civilian population.\(^66\) This is an additional requirement that is not present when deciding whether to exclude a terrorist act under Article 1F (b). Furthermore, a terrorist attack would only breach Article 1F(c) if it had a major impact upon international relations.\(^67\) This would clearly not cover all terrorist attacks. Therefore, while Articles 1F (a), (b) and (c) are all capable of excluding terrorists, they apply in different situations.\(^68\) Article 1F(b) is most relevant for the vast majority of terrorist attacks and as such the applicability of Articles 1F(a) and (c) to terrorism is not an argument in favour of abandoning the predominance test’s proportionality requirement.\(^69\)

Thus the predominance test is consistent with the context of the political crime exception.

**F. The Object and Purpose**

1. **Introduction**

The object and purpose of the provision is another vital consideration in determining whether the predominance test is a valid interpretation of the phrase ‘non-political crime’.\(^70\) However, because this phrase is an exception to an exclusion clause, it exists within a complicated web of interrelated purposes that need to be untangled before it is possible to analyse whether the predominance test furthers them or undermines them. This section therefore begins by describing these objects. It argues that the Refugee Convention has a humanitarian object and purpose, whereas Article 1F(b) is aimed at protecting the status of refugees and the security and sovereignty of receiving states, as well as encouraging ratification of the Refugee Convention. The political crime exception is designed to protect those who commit political crimes merely by exercising their human rights, prevent people being returned to states of origin to face unfair trials and extend protection to freedom fighters. This section argues that the predominance test, and particularly the proportionality component, furthers all these objects.

\(^{66}\) UNHCR, *Guidelines on International Protection No. 5: Application of the Exclusion Clauses: Article 1F of the 1951 Convention relating to the Status of Refugees*, HCR/GIP/03/05 (4 September 2003), [13].

\(^{67}\) Ibid, [17].

\(^{68}\) UNHCR, *Background Note on the Application of the Exclusion Clauses: Article 1F of the 1951 Convention relating to the Status of Refugees* (4 September 2003), [80], [83].

\(^{69}\) Ibid, [81], [83].

2. Article 1F(b)

The Refugee Convention itself has the humanitarian purpose of protecting refugees.\(^\text{71}\) This is balanced by the purposes of Article 1F (b). An examination of the travaux preparatorios reveals that this Article has three purposes. Firstly, the Contracting States did not want to diminish the unique international standing of refugees by bestowing this status on people who were unworthy of it.\(^\text{72}\) Secondly, this exclusion was a concession to the sovereign right of States to control who enters their territory and in particular their right and moral duty to exclude those who may pose a threat to their communities.\(^\text{73}\) Finally, the drafters of the Convention hoped that protecting States’ vital interests in this way would make them more willing to ratify the Refugee Convention and thus commit themselves to protecting refugees.\(^\text{74}\) The drafters were pragmatic and recognised that it would be counter-productive to extend refugee rights to criminals if this discouraged States from ratifying the Refugee Convention and thus denied all refugees these rights.\(^\text{75}\)

3. The Political Crimes Exception

The object and purpose of the political crimes exception to Article 1F (b) is more difficult to discern. It is not clear from the text of the Refugee Convention itself and it is not discussed in the travaux preparatorios. It is therefore necessary to turn to the discussion of this exception by the UNHCR and in the case law.

The UNHCR states in its document *Interpreting Article 1 of the 1951 Convention Relating to the Status of Refugees* that the purpose of the political crime exception is to protect those who breach the repressive laws of their state of origin merely by exercising their human rights, for example by openly expressing a political opinion.\(^\text{76}\) While this would undoubtedly serve the purpose of the Refugee Convention it seems too restrictive to be the only purpose, as most states of refuge would not consider such a crime to be ‘serious’.\(^\text{77}\)

\(^\text{71}\) UNHCR, *Background Note on the Application of the Exclusion Clauses: Article 1F of the 1951 Convention relating to the Status of Refugees* (4 September 2003), [3].
\(^\text{75}\) Ibid.
\(^\text{77}\) Igor Ovcharsuk v Minister of Immigration & Multicultural Affairs [1998] 1314 FCA (Branson J).
In *R v Governor of Pentonville Prison; Ex parte Cheng (Cheng)*, Lord Diplock suggested two purposes for the “offence of a political character” exception in the *United Kingdom’s Extradition Act 1870*. The first was avoiding entangling the United Kingdom in other nations’ domestic dissension. This is not relevant to the political crime exception in Article 1F (b) because making refugee determinations inherently involves making judgements about the domestic situation of other nations. In order to determine whether someone faces persecution in their state of origin it is necessary make an assessment of the circumstances existing in that country, which may have diplomatic consequences.

The second reason was preventing a fugitive being returned to a country where his or her trial would be unfair because of political bias. This purpose is far more pertinent because it upholds the Convention’s purpose of protecting the vulnerable from persecution. If a trial would be so tainted by political considerations that it would amount to political persecution then it accords with the humanitarian goals of the Convention to extend refugee status to that person, even if they have committed a serious crime.

Justice Kirby suggested another purpose of the political crime exception in *Singh* which, unlike *Cheng*, was a case dealing with the Refugee Convention. He argued that this exception was intended to protect people who commit serious crimes “for objectives that they viewed as justified and even noble”, such as the Indians who struggled for independence from the British. The political crime exception was therefore designed to prevent those who broke the law in the pursuit of self-determination being denied the benefits of refugee status. At first it seems unlikely that the colonial European states that made up the majority of original parties to the Refugee Convention would have wanted to protect those who sought to throw off the colonial yoke. However, self-determination is one of the fundamental principles of the United Nations, to which they belong and under whose auspices the Refugee Convention was drafted. Furthermore, there are hints in European extradition cases, such as *Cheng*, that the political

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78 *R v Governor of Pentonville Prison; Ex parte Cheng* [1973] AC 931 (Lord Diplomatic).
80 *R v Governor of Pentonville Prison; Ex parte Cheng* [1973] AC 931 (Lord Diplomatic).
81 Zimmerman and Wennholz, above n 5, 598.
83 Ibid.
84 Ibid.
crime exception in extradition law may also have been motivated by a concern to protect ‘freedom-fighters’, such as Garibaldi. Therefore this probably is a purpose of the exception.

4. Consistency With These Objects

The predominance test serves the purpose of ensuring that only the ‘worthy’ are granted refugee status. As explained above one of the purposes of Article 1F(b) is to protect the status of refugees by excluding unworthy applicants. Some of the purposes of the political crime exception are very similar. Presumably the reason why the drafters sought to protect freedom fighters and those who merely exercised their human rights, even if they were criminals, was because they were nonetheless viewed as being worthy of refugee status. ‘Worthiness’ is a value-laden concept that inherently imports considerations of moral culpability. The predominance test is flexible enough to allow decision-makers to consider the circumstances that would affect whether any particular applicant deserved refugee status, such as the motive of the crime, its proportionality and its target.

The predominance test also furthers Article 1F(b)’s purpose of allowing States to protect their communities from dangerous criminals. As discussed above, the ordinary meaning of political is completely neutral. If the ordinary meaning were followed in the interpretation of the political crime exception a terrorist who killed innocent people would be just as entitled to protection as a refugee as a peaceful activist who angered an oppressive government by distributing pamphlets. This would completely undermine the purpose of protecting the communities of receiving states. The predominance test is flexible enough to address this problem by allowing decision-makers to exclude dangerous criminals who have committed disproportionately violent crimes against the innocent.

Furthermore, by upholding the objects of excluding unworthy and dangerous criminals, the predominance test also implements the related object of maintaining political goodwill for the refugee system. If unworthy applicants, such as terrorists and other dangerous criminals, are granted refugee status it may cause the people of the states of refuge to perceive refugees as threats who

87 R v Governor of Pentonville Prison; Ex parte Cheng [1973] AC 931; T v Secretary of State for the Home Department [1995] 2 All ER 1042.
90 Quinn v Robinson extracted in Gil v Canada [1995] 1 FC 508.
91 T v Secretary of State for the Home Department [1995] 2 All ER 1042.
are undeserving of protection. This may cause them to question the entire refugee system. Democratic governments would be aware of this prevailing attitude and respond accordingly by restricting refugee rights. Hostility to refugees is already high, making it difficult for many vulnerable people to access the protection they need. Allowing the refugee system to turn receiving states into a safe haven for terrorists and those who have committed other ‘atrocious’ crimes would only aggravate the situation.

Finally, the predominance test is also consistent with the political crime exception’s object of not returning someone to face a trial that is tainted by political considerations. If a decision-maker decides that there are serious reasons for considering that a person committed a crime that was so violent and abhorrent that it was disproportionate to its motive and therefore not political, it is likely that the political aspect of any trial would be completely overshadowed by its criminal aspect. For example, in a trial of a terrorist attack that killed many civilians the political motive would be almost irrelevant. Even if the authorities conducting the trial looked unfavourably on the suspect because of his or her political motivation, they would be far more concerned with the deaths of innocent people. In contrast, distributing political pamphlets would not be disproportionate. A person who committed this crime would therefore pass the predominance test. This means they would not be put at risk of being returned to their state of origin where any trial they would face would be dominated by political bias because their political motivation for distributing the pamphlets would be the central aspect of the crime. Therefore, the proportionality aspect of the predominance test allows decision-makers to protect those applicants who are risk of facing an unfair trial, but exclude those whose trial would mainly be concerned with criminal, rather than political, matters.

5. Conclusion

Therefore the predominance test, and particularly its proportionality component, accords with the objects of the provision.

92 UNHCR, Background Note on the Application of the Exclusion Clauses: Article 1F of the 1951 Convention relating to the Status of Refugees (4 September 2003), [84]; Nyinah, above n 3, 310.
95 Kälin, above n 18, 64.
G. Concluding remarks

The predominance test is an excellent interpretation of the political crime exception. It is a good faith interpretation that generally accords with the ordinary meaning, context and purpose of the provision. While the proportionality component of the test is contrary to the ordinary meaning of the words used, this is acceptable because it is crucial to give effect to the provision’s objects and purposes. This test should therefore be applied by all Contracting States, as well as the UNHCR, in the interests of consistency, predictability and fairness.

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Reducing Car Use in Canberra: A Holistic Policy Approach

Elizabeth P. Proctor

Abstract

Reducing car use allows cities to lower greenhouse gas emissions and improve population health and social welfare. Car use can be made less attractive by making driving less convenient, making other modes of transport more convenient, and by nudging people into reconsidering their habits where driving has become impractical. A mixture of all three options is optimal, and most effective with people who are open to changing their behaviour. With transport playing a complex role in everyday life, a holistic approach to its use is essential. The Australian Capital Territory (ACT) Government has sound aims regarding sustainable transport, but its Transport for Canberra: Transport for a sustainable city 2012–2031 report published in 2012 contains some contradictions and inefficiencies in the effort to shift Canberra’s population away from driving as a default travel mode. The lack of evidence-based public transport plans and behaviour change programs will weaken Canberra’s efforts, and the failure to reduce road supply will oppose them. The ACT Government has failed to fully seize the opportunity to reduce car use and hence improve population health and social welfare.

Introduction

The private car is being used in Canberra at a level that is not sustainable for human or environmental wellbeing. This article will look at Canberra’s transport system and how it can encourage sustainable travel by targeting the most easily altered car trips through a combination of diverse policy measures. Given the urgency of reducing our greenhouse gas (GHG) emissions within this ‘critical decade’, the article will focus on short-run options (to the exclusion of land-use planning). It will then assess the ACT Government’s current vision by reviewing the Transport for Canberra report, examining whether the proposed measures to reduce Canberran car use are evidence-based and likely to be effective.
Methodology

This article is the result of an extensive literature review conducted with the aim of understanding factors that increase and reduce urban car use. It draws upon the author's experience gained when undertaking the 'Human Ecology' program at The Australian National University's Fenner School of Environment and Society. This approach emphasises a systems thinking approach, resulting in an understanding that car use is part of the overall function and design of a city and cannot be studied or addressed in isolation from urban form, public transport and active travel policy. A diverse range of sources and topics were therefore included. The reading list was compiled by searching ANU Library SuperSearch, ScienceDirect and ProQuest with a wide range of search terms including “reduce” “car use” “public transport/transit” “active travel” “cycling” “pedestrian” “Canberra” “transport emissions” “transport policy” “travel behaviour” “TravelSmart”. Conversations with the project supervisor and others (Personal communications) provided new directions and topics for investigation throughout the process, as well as pursuing any papers frequently referenced throughout the collection. As this article assesses transport policy that is specific to Canberra, an effort has been made to use local information where available, though much parallel information exists from North America and Europe which informed the work (e.g. Appleyard, 1976; Bassett et al., 2011; Brog et al., 2009; Hass-Klau et al., 2000; Loukopoulos et al., 2005).

Part 1: Why and how to reduce car use

The need to transform urban transport in Canberra

Reducing Canberran driving will have benefits on three key scales: the planet, the city and individual residents.

Car use is a key component of Canberra’s contribution to climate change. The global crisis of climate change and the need to respond is well documented, and Canberra faces the challenge of reducing per capita emissions by a factor of 22 (Moriarty & Honnery, 2008). Transport makes up 23% of Canberra’s emissions, and since fuel efficiency gains for cars are likely to be offset by the increased inefficiency of accessing fossil fuels, that can be best reduced by cutting down on car travel (Moriarty & Honnery, 2008; Office of the Commissioner for Sustainability and the Environment, 2008). Reducing car use is an important part of global climate change mitigation efforts, as private car travel makes up around 80% of vehicle kilometres travelled (VKT) in OECD countries (Graham-Rowe et al., 2011).
Cars are more popular in Canberra than other Australian cities at 81% of commute trips, with public transport (PT), walking and cycling playing minor roles (Office of the Commissioner for Sustainability and the Environment, 2008). Within the city of Canberra, local car VKT reductions benefit the community in the following ways: air pollution is reduced, leading to fewer cases of asthma and related health problems (ARRB Transport Research, 2002); congestion is reduced, improving all road travel (Ashton-Graham, 2008); and the nature of streets changes significantly. Streets are made safer by the presence of cyclists and pedestrians (Taylor & Ampt, 2003), and the less traffic a street has, the more sociable its residents are – car-oriented streets degrade the social fabric of neighbourhoods (Appleyard, 1976). Those without access to cars benefit from a transport system that improves as demand increases, and better shops in walking distance that receive increased custom (Whitehead et al., 2006, cited in Santos et al., 2010; ACT Government, 2011).

On an individual scale, a person who uses cars less will be healthier and save money. Choosing any other mode of transport improves health and life expectancy, with public transport commuters far more likely to exercise for the World Health Organisation’s recommended 30 minutes per day (Besser & Dannenberg, 2005; Brog et al., 2009). Aside from reduced health costs later in life, driving less saves money, public transport being approximately half the cost of a car per kilometre, cycling 20% and walking 10% (including the price of shoes) (Victorian Transport Policy Institute, 2011).

Why do people choose cars?

For a government to change public attitudes towards cars and sustainable transport, it is important to understand what makes driving attractive. People use cars for practical and psychological reasons. The decision is affected by practical and social circumstances as well as values (Anable, 2005; Collins & Chambers, 2005). A person may have values that oppose car use, but this can be outweighed by their situation or by positive social attitudes towards cars (Anable, 2005; Eriksson et al., 2010). The role of emotion is not always apparent due to the overlap between emotional and practical reasoning, with drivers citing practical reasons for choosing cars and constructing a narrative around time pressures or convenience to justify otherwise illogical and impractical behaviour (Van Exel & Rietveld, 2009). Once the decision to drive has been made it tends to stick, regardless of logic or whether it matches the person’s values (Anable, 2005; Van Exel & Rietveld, 2009). A sound strategy to reduce driving must look beyond the nominated factors that go into travel decisions and address both the practical and emotional factors involved (Marshall & Banister, 2000; Graham-Rowe et al., 2011).
Which car users are we addressing?

There are already car users willing to drive less for personal and environmental benefits. It is effective to specifically target this segment of the population, sometimes described as ‘aspiring environmentalists’ (Anable, 2005) or ‘aspiring green travellers’, people who drive but wish they didn’t (Prillwitz & Barr, 2011). ‘Malcontented motorists’ are similar – they feel driving is their best option but are open to change (Anable, 2005). These groups can be guided to change their behaviours (Taylor & Ampt, 2003; Tranter & May, 2005; Beirao and Carbal, 2007; Brog et al., 2009; Graham-Rowe et al., 2011). Defined as attitudinal segments, the sizes of the groups vary, being estimated at 48% together in Anable (2005). 43% of respondents in a Belconnen travel behaviour program were interested in reducing their car use, indicating a similar level of opportunity in Canberra (Office of the Commissioner for Sustainability and the Environment, 2008). Focusing policy efforts where the existing attitudes are open to change is the most efficient way to reduce car use in a city.

‘Aspiring environmentalists’ and ‘malcontented motorists’ currently drive because they feel unable to give it up (Anable, 2005). They are willing to change their behaviour, but perceive a barrier to doing so. For some, their circumstances make driving the most practical option. In other cases, there is a misperception of the relative costs and benefits of cars and/or public transport and active transport (cycling and walking) (Ashton-Graham, C., 2008; Van Exel and Rietveld, 2009). For many drivers, continued car use is a result of practical and emotional factors, so driving needs to both become less practical and become seen to be less practical in order to affect the most people (Collins & Chambers, 2005; Ashton-Graham, 2008; Brog et al., 2009).

No silver bullets

Driving in Canberra needs to lose its dominating appeal. Achieving this is possible by making driving directly less attractive (through ‘push’ measures) and by improving the alternatives (‘pull’ measures). The options outlined in this article have proven effective elsewhere (Ashton-Graham, 2008; Australian Greenhouse Office, 2006; Krizek et al., 2009; Santos et al., 2010) and would be appropriate for Canberra.

The intention of this article is not to identify any single best policy. People’s transport decisions and needs are complex, and travel is a process shaped by many factors, including the layout of a city, the locations of home, childcare, schools, work and study, the landscape and transport systems around us, and our own feelings and attitudes towards travel (Cools et al., 2009). Delivering socially and environmentally sound transport to a city is a problem with no
silver bullet solution (Krizek et al., 2009). A sensitive, successful transport policy has many benefits in all the areas of life that transport touches – health, equality of access, social streets, and global climate change. The complexity of our transport systems necessitates a multi-pronged response. As a result, the policy measures examined here are not intended as options off a menu, but as components of a holistic transport policy best enacted simultaneously and with attention to context.

**Push measures: The stick**

**Parking**

The most obvious way to ‘push’ people away from cars is to make it more expensive. Driving has many expenses which could be increased, but fixed costs like registration and vehicle stamp duties are less ‘visible’ to consumers and are usually ignored in everyday cost calculations (Tranter & May, 2005). Fuel prices have little impact on car use (Eriksson et al., 2010), and a fuel tax cannot target drivers by destination, affecting rural trips as much as urban ones, despite their different access to alternative travel modes. Parking prices are an excellent candidate for pricing signalling (Beirao & Carbal, 2007), particularly since Canberra currently has such low prices and the government spends a considerable amount constructing and maintaining public parking (ACT Government, 2011). As an ongoing cost, parking charges are frequently noted by drivers. Parking costs, like congestion charging road tolls (which are rarer and seem less likely in Canberra), can specifically target people driving to town centres which are well serviced by public transport and walking paths, making a clear link between daily out-of-pocket cost and the alternative travel choices available.

**Road space**

The convenience and speed of the car makes it the most attractive option in Canberra (Office of the Commissioner for Sustainability and the Environment, 2008). Reducing convenience and speed affects the practicality of the car. The relative time advantage of driving is a strong influence, with the majority of drivers willing to consider PT if it’s faster than a car (Collins & Chambers, 2005). Converting road lanes to cycle lanes or exclusive bus lanes sends a clear signal regarding which modes can enjoy low traffic and reduces road space for cars, but Canberra has very little congestion at present to make driving off-putting (ACT Government, 2011). Given Canberra’s projected population growth (ACT Planning and Land Authority, 2007) and trend for increased car use (Mees et al., 2008), the simple act of not continually expanding the road capacity could eventually increase congestion and discourage peak hour driving, as well as
freeing up for funds for use on PT and active transport infrastructure (Pedal Power ACT, 2011). Reducing the per capita allowance of road space may cancel out the positive feedback effect of getting drivers off the road; instead of making the road therefore more attractive to remaining drivers, the extra road space will continue to shrink as the population grows.

**Pull measures: The carrot**

Push measures are unpopular with drivers, hence the relatively unobtrusive push policies suggested. Pull measures are preferred, as they are seen as non-invasive and respectful of individual choice (Stradline et al., 2000; Loukopoulos et al., 2005), and so can be more widely and openly promoted as part of Canberra’s sustainable transport effort.

**Public transport**

The most practical and central ‘pull’ measure would be to improve public transport. Without a quality PT system to switch to, pushing people out of cars is a pointless exercise (Collins & Chambers, 2005). At present, Canberra’s PT usage is lower than the national level, at 8.8% of work trips, contrasting with around 14% in Melbourne and Brisbane (Australian Bureau of Statistics, 2009; Mees, 2009). Canberra is widely known as a car-dependent city with poor public transport (Office of the Commissioner for Sustainability and the Environment, 2008; Mees et al., 2008).

There is no one definition of an attractive, high quality PT service, but a few basic principles have emerged. PT must be affordable, frequent and close, achieving low walk and wait times (see Table 1).

**Table 1: Canberra’s current PT system does not meet the basic criteria to attract drivers**

<table>
<thead>
<tr>
<th>PT criteria</th>
<th>Does Canberra have it?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affordable</td>
<td>Yes</td>
</tr>
<tr>
<td>Close to home</td>
<td>Yes</td>
</tr>
<tr>
<td>Frequent</td>
<td>No</td>
</tr>
</tbody>
</table>

Patronage will increase significantly if a service comes at a frequency of 15 minutes or greater all day (Walker, 2009), routes should be direct rather than meandering and the vehicles and waiting areas should be pleasant, safe and comfortable (Beirao & Carbal, 2007). There is a constant trade-off between making services affordable, frequent, widely available and close to homes, with Canberra’s bus network currently reaching many places at low prices, but infrequently (Walker, 2008; e.g. see Action, 2010a; Action, 2010b). The resulting low patronage means that the system requires an 80% subsidy (Territory and Municipal Services, 2011).
Calls for better PT in the ACT are frequent and often pessimistic, particularly due to the belief that Canberra’s physical layout restricts its ability to provide a good PT system (Joint Standing Committee on the National Capital and External Territories, 2008), but quality transport is not impossible. Canberra actually has a higher population density than Brisbane, but Brisbane outshines Canberra’s 8.8% PT use at 13.8% (Mees, 2009; Australian Bureau of Statistics, 2011). These figures, alongside an account of Canberra’s history of quality, low subsidy PT ($39 million in 1984; $98 million in 2001 - Mees, 2011), indicate that the obstacles to good PT are not physical or financial, but rather stem from a lack of evidence-based policy.

Active travel

Active travel – cycling and walking – currently plays a minor recreational role in Canberra, despite being a big part of the city’s original design (Manning, 1984). Active travel rates are slightly higher in Canberra than other capital cities (Office of the Commissioner for Sustainability and the Environment, 2008), but this is partly because the PT is of such poor quality (Mees et al., 2008). Active travel makes up 6.2% of commutes in Canberra. European cities achieve active travel rates above 30% and sometimes as high as 45%. In light of this, Canberra can do much better (Bassett et al., 2011).

While a consensus is developing on the need to provide quality infrastructure for active travel, exactly what key features a street or suburb needs to attract walkers and cyclists remains unclear (Krizek et al., 2009). A major literature review for Victoria’s Department of Transport concluded that locally sensitive community design, quality sidewalks and perceived safety were among the most important factors (Krizek et al., 2009). More importantly, it found that the high variability in local needs and urban layouts demands holistic, sensitive policy approaches, with no one ‘silver bullet’ able to increase active travel (Krizek et al., 2009). In Canberra’s case, the pedestrian environment is widely considered to be pleasant but improvable, with desired changes varying widely across localities (Wedderburn, 2011). The cycling network is extensive, but more can be done, particularly integrating cycling into public transport and providing end-of-trip facilities (parking, showers etc) (Wardman et al., 2007). Advocacy groups continue to report dissatisfaction with the infrastructure (Women’s Centre for Health Matters, 2011; Pedal Power, undated), disputing the boast of Canberra having “one of the most extensive walking and cycling networks in Australia” (ACT Government, 2011: 37; Canberra Pedestrian Forum, 2011). Active travel will require both more funding and more detailed policy attention in order to become a more popular travel mode (Mees et al., 2008).

Behaviour change programs

Infrastructure improvements are important, but cannot by themselves cause significant behaviour change. However good the non-car transport options
are, drivers tend to underestimate their quality and feel unable to stop driving (Ashton-Graham, 2008). Getting drivers to reconsider other transport options and discover their true quality can be done using travel change behaviour programs, most commonly known in Australia as TravelSmart.

TravelSmart programs are an entirely voluntary way of getting drivers out of cars. Willing households sign up to receive information about their travel options and are supported to try out alternative travel modes for a few weeks. The finer points of methodology and evaluation are still under debate (Australian Greenhouse Office, 2006), but TravelSmart programs have consistently shown reductions in vehicle kilometres travelled (VKT) that persist for at least 5 years (Australian Greenhouse Office, 2006; Ashton-Graham, 2008; Brog et al., 2009). VKT reduction varies depending on circumstances; it can be as low as 7% or as high as 17%, with far greater results when delivered alongside PT improvements (Ashton-Graham, 2008). By changing household habits, these programs improve population health and reduce road use, creating savings for governments with a $30 return for every $1 invested (Ker I, 2002, cited in Ashton-Graham, 2008). TravelSmart also achieves carbon abatement at $40 per tonne over 5 years, dropping as low as $20 if the changes endure a full decade as they are predicted to do (Ashton-Graham, 2008). Though a relatively new addition to the policy options, TravelSmart has become a “legitimate and cost effective part of the solution to climate change” (Ashton-Graham, 2008: 14) by helping willing drivers out of their cars. TravelSmart can play an important role in Canberra as the government tries to shift the population away from car-centred travel habits.

**Part 2: How does Canberra compare?**

**Applications in Canberra: Fertile ground**

The ACT Government released the draft *Transport for Canberra: Transport for a sustainable city 2011–2031* in late 2011. It outlines the government’s intentions and vision for a city with a sustainable transport system that services everyone’s needs. It feeds into Canberra’s *Weathering the Change Action Plan 2* with the twin goals of “reducing our travel by private passenger car... and making our vehicles less emissions intensive” (ACT Government, 2011:6). Canberra wants to “encourage more people to choose sustainable transport” (ACT Government, 2011: iii) over cars. The ACT Government clearly aims to make driving a less attractive option for its citizens. The following section examines whether *Transport for Canberra* makes use of the key strategies outlined above to achieve reduced car use.
Following the evidence

In the areas of managing travel demand through parking costs and promoting active travel, the Transport for Canberra draft is utilising the best available information to form sound principles and strategies, although the level of commitment is generally either unstated or minimal.

The ACT Government’s parking plan is based on sound evidence of a good way to manage travel demand. Though not particularly detailed, the plan includes pricing and supplying parking in a way that will reduce parking demand and ‘discourage private vehicle travel’ (ACT Government, 2011: 52), with plans to reduce the number of spaces in town centres (ACT Government, 2011). While the government’s decision to control most of the supply non-commercially has been criticised (Planning Institute Australia, 2011), the government’s overall intention of reducing the parking supply and increasing the price follows one of the most commonly recommended ways to promote sustainable transport (see Beirao and Carbal, 2007; Van Exel and Rietveld, 2009; Krizek et al., 2009).

Transport for Canberra does a fair job of capturing the underlying principles of supporting active travel, including multi-modal trip integration (being able to ride or walk as part of a bus trip), quality infrastructure and perceived safety as key concerns (Krizek et al., 2009; ACT Government, 2011). Overall, the plans fit well with the recommendations from local travel groups, with a lack of ambition and clarity being their key concern (Canberra Pedestrian Forum, 2011; Pedal Power, 2011). The improvements laid out in Transport for Canberra fall far short of those recommended in a recent active travel feasibility study for Canberra, including TravelSmart programs and widespread cycling training, and end-of-trip facilities at all major workplaces (Sinclair Knight Merz, 2009). It is worth taking local active travel groups seriously, as they can provide local and detailed feedback on infrastructure policy. They also have a potential role in supporting the government by promoting sustainable travel over car use (Santos et al., 2010). Despite the sound principles established regarding active travel, the government could do a lot more in terms of specific commitments (see Pedal Power, 2011) and funding, having spent $17.11 per household on cycling last year in contrast with Brisbane’s $66.70 per household per annum (Cardno Eppell Olsen, 2011).

Time to think again: Following some evidence

The methods outlined in the Transport for Canberra report regarding PT improvement and sustainable travel promotion are not based on the best available evidence, and have been widely criticised (see Bresnan, 2011; Mees, 2011; Pedal
Power ACT, 2011). While the best ways to improve PT and promote its use may remain under debate, it is not clear that the ACT Government is thoroughly following any evidence-based theory on delivering effective public transport.

Improving public transport is a major component of Transport for Canberra. The intended increases in service are a fitting part of any sustainable transport plan, but it is not clear whether the locations of the increased services will effectively attract car users or serve the general population. The frequent services (every 15 minutes or better) have been located based on a ‘build it and they will come’ model where the transport system attempts to pressure people into relocating: “the key message is ‘for access to fast, frequent and reliable public transport services, locate on the Frequent Network’” (ACT Government, 2011:14; Walker, 2008). That means that for as long as it takes for Canberra’s population distribution to change, many people will continue to live far from any frequent services, in a transport plan that is “looking forward to 2050” (Pers. comm., 2012b) to the detriment of current needs.

There are only two frequent network services (local and rapid) planned south of the Woden town centre in 2031, contrasting with four in the inner north (three of them servicing only that local area) (ACT Government, 2011). Given that the inner north houses 13% of Canberra’s population, while Woden and Tuggeranong combine to house 35%, it is clear that this is not based on serving the most people. It doesn’t even serve the most densely populated areas. Belconnen, Tuggeranong and Gungahlin all boast population densities at least double that of the Inner North (Australian Bureau of Statistics, 2011), yet have few or no frequent local routes planned through their suburban areas for the next two decades (ACT Government, 2011).

Evidence by transport experts such as Dr Paul Mees shows that Canberra used to have high quality transport at a lower subsidy cost simply by coordinating timetables and prioritising local routes, something the ACT Greens continue to recommend (Bresnan, 2011; Mees, 2011). These methods gave Canberra a PT system on par with Melbourne’s for per capita usage in previous decades (Mees, 2011); highlighting the fact that Canberra’s physical landscape is not the insurmountable obstacle it is commonly believed it to be (Joint Standing Committee on the National Capital and External Territories, 2008). The departmental reshuffle that accompanied ACT Government disrupted these improvements, with the National Capital Development Commissions (NCDC) upholding an emphasis on cars while ACTION, Canberra’s bus service, lost support from the reorganised Department of Territories. The bus service’s subsequent fall from grace was a result of funding and policy priorities, not an inevitable outcome in the context of Canberra (Mees, 2011).
Determining the optimal PT system is clearly a complex task, but the frequent service network proposed in *Transport for Canberra* is not an effective way to service the existing population or even the most densely settled parts of the city. While committing to key trunk routes along the major roads does encourage future settlement and investment (Hass-Klau et al., 2000; Walker, 2008), this could be done alongside an increased, better distributed spread of frequent local services that will both make buses more competitive alongside cars and reduce the need to own a car in order to access frequent services via “park and ride”, which in the present plan will become the experience for most of southern Canberra. At present, it appears that the ACT Government is pursuing a PT policy that will fail to attract car users in large parts of the city.

It is well established that behaviour change programs can be the final piece to the puzzle of making driving less attractive. TravelSmart programs have had success across Australia, including a pilot study in Belconnen in 2007 (Australian Greenhouse Office, 2006; Office of the Commissioner for Sustainability and the Environment, 2008). The pilot program was considered a success, noted in *Transport for Canberra* for reducing VKT 13% (ACT Government, 2011). In light of this, it is unclear why the government has no intention of repeating the household-based program that has proven most successful, instead supporting work-place and school-based programs that are far more variable in their success rates (Australian Greenhouse Office, 2006). The Australian Greenhouse Office has declared Australia ready for large-scale household programs, while noting that both workplace and school programs are in need of further study, being unreliable due to lack of control by the program office and high variability in implementation methods (ibid). Focusing on the more consistent household-based TravelSmart programs will more effectively shift people away from driving, particularly as the decision to drive is frequently impacted by the behaviours and situation of the whole household (Brog et al., 2009). The school and workplace focus may be a strategy to find funding, since the Health Department is paying for the school programs and workplaces often pick up some costs (ACT Health, undated), but the savings are not worthwhile if the programs are ineffective. It is important to take a holistic view when allocating TravelSmart funding, as a successful household-based program can save the government money in road maintenance, health, and road accident compensation (Office of the Commissioner for Sustainability and the Environment, 2008).

**Flying in the face of the evidence**

The plan to expand Canberra’s road network has no place in an evidence-based, holistic attempt to make transport more sustainable. From its low starting point, Canberra is facing increasing congestion over the next few decades (ACT Government, 2011). This can be viewed as either a problem or an opportunity.
Congestion causes pollution and increased emissions from vehicles, but also slows private car travel time, making other modes more competitive (Van Exel and Rietveld, 2009). Managing congestion with traffic-light timing and travel advice programs can have positive effects, but in the end road capacity is the ultimate driver. The first priority for the ACT road network is stated as “completing key road infrastructure, improving capacity and maintaining our road assets” (ACT Government, 2011: 41). ‘Completing’ and ‘improving’ Canberra’s already extensive road network will never ultimately solve our potential congestion problem. Governments the world over have discovered that you can’t build your way out of the traffic; more roads simply attract more drivers at exactly the wrong time through ‘induced demand’ (Manning, 1984; Hutchinson, 2011). It’s also an expensive option, and not what the public wants. Transport for Canberra opens with the finding that residents want around 20% of funds spent on maintaining our road network, with the rest used to improve our public and active transport facilities. Only five pages later, the government reports having spent around $380 million on active and public transport, and over $700 million on the road network this past decade, an extreme inverse of the public’s stated preference (ACT Government, 2011: 7-12; Bresnan, 2011). People may not welcome drastic cuts in road spending to the extent indicated in the survey, but this is an opportunity to reconsider the ACT’s funding priorities. Continuing to upgrade Canberra’s already high quality road network will be an expensive way of perpetuating a reinforcing feedback cycle between the supply and demand of road space for private cars, undermining the government’s efforts to make alternative modes more attractive and competitive (Mees et al., 2008; Pedal Power ACT, 2011).

Near enough is not good enough: Missed opportunities

While the ACT Government has good transport policy in some areas, Transport for Canberra is not holistic transport policy, and an opportunity to shift social norms has been missed. Not only do travel policies work far better when enacted as a complementary, holistic set (Marshall & Banister, 2000; Ashton-Graham, 2008; Eriksson et al., 2010; Graham-Rowe et al., 2011), but rolling out the full set of policies at once creates the opportunity to have a public conversation about the many benefits of sustainable transport and raise environmental awareness. This has the potential to change the accepted social norms on car use, reaching out to those who have neutral attitudes – ‘malcontented motorists’ and ‘complacent car addicts’, and marginalising ‘die-hard drivers’ – those who refuse to consider other travel modes (Anable, 2005). This change of attitudes is another key element in the long-run effort to promote sustainable travel (Tribbia, 2007). The need to approach car-reduction policies from multiple angles is now
well understood, with studies on active travel addressing parking pricing and TravelSmart programs (Krizek et al., 2009; Sinclair Knight Merz, 2009), TravelSmart literature commenting on PT improvements (Marshall & Banister, 2000; Brog et al., 2009), and studies of reducing car use returning repeatedly to the principle of holistic transport policy (Graham-Rowe et al., 2011). Canberra has ignored this bigger picture in forming transport policy.

Areas for future study

Looking beyond good policy choices, a related area for study could be the issues that hinder their implementation. The ACT Government has struggled to deliver good transport policy, and continues to struggle, indicating that barriers must exist. It’s not clear exactly where the buck stops on transport policy in Canberra – is it politicians, Treasury, ACTION? The relationship between political and bureaucratic barriers is complex and depends on perspective (Pers. comm., 2012a), with no clear way of moving forward. The multiple organisations and jurisdictions involved further complicate things, particularly the continued role of the National Capital Authority in the parliamentary triangle (Joint Standing Committee on the National Capital and External Territories, 2008). Add to this the possibility that reducing car use, while good for society, will make for unpopular policy facing opposition from car users and the way forward looks challenging indeed. Teasing out the political and bureaucratic issues to discover the best levers for change could be a fruitful area for future research.

Conclusion

Reducing car use is possible, but requires a holistic approach that is lacking in Canberra. Making the car experience less palatable and less popular in Canberra requires an understanding of the forces that influence people’s transport decisions, and a willingness to address each of those forces through a holistic policy approach. Both push and pull measures are needed, with parking and road supply standing out as effective push measures, and good PT and active travel facilities as essential pull measures, all facilitated by the final step of getting drivers to rethink their habits through a behaviour change program. Success has benefits from the local to the global scale, including improved population health and social welfare. Canberra will miss out on potential benefits because the ACT Government is not effectively using key parts of good transport policy, most problematically road supply and evidence-based PT and behaviour change programs. Their approach remains piecemeal, with an admirable goal for reducing driving in Canberra but an inconsistent policy mix. Given the interdependent
nature of the policy areas around car use and sustainable transport, it can be expected that this patchy attempt at making cars less attractive in Canberra will fall far short of the city’s potential to shed its car dependence.

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References


**Personal communications**


Pers. comm., 2012b. Interview with Adam Taylor, ANU Green. 6 February 2012, Canberra.

Craig Wang

Abstract

In multi-agent systems, the consensus protocol is a distributed algorithm that instructs the information exchange between neighbouring agents in order to reach a consensus state for all of the agents within the network. Consensus problems have an extensive range of applications, including formation control problems (mobile robots, unmanned aerial vehicles, and automated highway systems), flocking, coupled oscillators, and payload transportation. In this report, we provide a brief review of consensus protocols and their applications. We propose an adaptive coefficient setting method for two-hop relay protocol, and analyse it in comparison with the Metropolis method for nearest neighbour protocol. The simulation shows that there is a significant improvement on the consensus speed thus the coefficient setting method can be more efficiently used in these applications. We also evaluate the effect of network topology on the power systems.

Introduction

Consensus problems generally involve information exchange between agents within the network; a common group objective is reached through agents interacting with each other. These problems cover many disciplines. For example, biologists use them to study the collective behaviour of animals such as ants, birds and fish, known as flocking [1]; physicists use them to study synchronization of coupled oscillators [2], which could increase the performance of oscillator networks; the engineers implement the theory to solve
real world problems such as Smart Grid, a modernization of the electricity grid, that can significantly increase the efficiency of electricity distribution; yet most theoretical analyses have so far relied on matrix and graph theory.

A consensus protocol is a distributed method of obtaining global information or achieving a common group objective by enabling communication between agents in the system. Distributed methods are more suitable for large networks than centralised methods, as they enable better performance and faster operation. Another advantage is that they are able to increase the ability of the system to survive single point failures, therefore creating a more robust system. The protocols can also be designed specifically for different applications due to their versatility.

In this report, we further investigate consensus protocols. Firstly, we outline preliminary knowledge and notation on matrix theory and graph theory. Secondly, we present a discussion on different forms of consensus protocols that currently exist, such as switching topology versus fixed topology and nearest neighbour versus multi-hop protocol. We also outline some of the important applications of these protocols, including Smart Grid, flocking, and synchronization of coupled oscillators.

In the second part of the report, we investigate two main problems. Firstly, the effect of network topology on consensus speed, specifically tree, ring, star, two-hop and complete topologies. Secondly, an investigation of two-hop relay (second-order neighbour) protocol performance. We briefly introduce the two-hop consensus protocol which has previously been discussed in [3] and [4]. Since there are no explicit descriptions about the coefficients, we fill in this gap by proposing an adaptive coefficient setting method for the two-hop consensus, which leads to the key contribution of this paper. We provide simulation results followed by discussions on the consensus process in comparison with the existing method. At last, we will conclude our project and propose some future research directions.

The goals of this project are to understand the basic concepts of consensus protocols, their applications, and to investigate different ways of increasing the consensus speed. This investigation was motivated by Smart Grid and other power system applications. Ideally this project will set the foundation for the future research in the field of Consensus Protocols.
Preliminaries

1. Graph theory

The network topology for a group of agents is represented as a graph, $G = (V, E)$, where $v_i \in V$ is the set of nodes where $i = 1, 2, \ldots, n$, and $e_{ij} = (v_i, v_j) \in E$ is the set of edges joining agents of index $i$ and $j$. $v_i$ and $v_j$ are neighbours of each other if there exists $e = (v_i, v_j)$, the first order neighbours of agent $i$ is denoted as $N_i = \{v_j \in V | (v_i, v_j) \in E\}$. The second order neighbours of agent $i$ is denoted as $N_i^2 = \{v_k \in V | v_k \in N_j, v_j \in N_i, k \neq i \text{ and } k \neq j\}$.

A graph is undirected if $e_{ij} \in E$ implies $e_{ji} \in E$. Otherwise the graph is directed. A complete graph is when all the nodes are neighbours of each other. The degree of a node is denoted by $|N_i|$, which is the total number of first order neighbours, the out-degree of $v_i$ is the number of edges $e_{ij} = (v_i, v_j)$.

2. Matrix theory

The adjacency matrix $A = [a_{ij}] \in \mathbb{R}^{n \times n}$ of graph $G$ of $n$ agents is defined by:

$$a_{ij} = \begin{cases} 1, & v_j \in N_i \\ 0, & \text{otherwise} \end{cases}$$

The diagonal matrix $D = [d_{ij}] \in \mathbb{R}^{n \times n}$ of graph $G$ of $n$ agents is defined by:

$$d_{ij} = \begin{cases} 0, & \text{ otherwise} \\ |N_j|, & i = j \end{cases}$$

The Laplacian $L = [l_{ij}] \in \mathbb{R}^{n \times n}$ of graph $G$ of $n$ agents is given by $L = D - A$, such that

$$l_{ij} = \begin{cases} -1, & v_j \in N_i \\ |N_i|, & j = i \\ 0, & \text{otherwise} \end{cases}$$

Since both the row sum and column sum of a graph Laplacian is 0, the Laplacian matrix always has a zero eigenvalue $\lambda_1 = 0$, and it has eigenvalues of $0 = \lambda_1 \leq \lambda_2 \leq \lambda_3 \ldots \leq \lambda_n$, where the second smallest eigenvalue $\lambda_2$ is called the algebraic connectivity of a graph.

Discussion on consensus protocol

Consensus problems involve an information exchange process, in which agents within the system communicate with each other via a pre-determined consensus protocol. A consensus, i.e. a common value or objective is reached after certain
time or certain iterations. It was first discussed in computer science, now it has found its way into many other areas including biology, physics and engineering. We will focus on the multi-agent coordination aspects of consensus problems.

A continuous time linear consensus protocol is described in [6-9], and widely used in other research papers, the dynamics are described as: $\dot{x}_i = \sum_{j \in \mathcal{N}_i} a_{ij} (x_j - x_i)$, where $x_i$ represents the information state of the $i$th agent, $\dot{x}_i$ represents the rate of change of $x_i$ and $a_{ij}$ is the adjacency matrix cell associated with the edge $(v_i, v_j)$. In other papers [3, 5], $a_{ij}$ is treated as the weighted adjacency matrix, where $0 < a_{ij} < 1$ if $v_i$ and $v_j$ are neighbours, otherwise $a_{ij} = 0$. This protocol can also be written as $\dot{x} = -Lx$, where $L$ is the graph laplacian.

The corresponding discrete time protocol is $x_{i}^{k+1} = x_i^k + \sum_{j \in \mathcal{N}_i} a_{ij} (x_j^k - x_i^k)$, where $x_i^k$ represents the information state of the $i$th agent at the $k$th iteration. This protocol can be represented in the matrix form as $X^{k+1} = P \cdot X^k$, where $P \in \mathbb{R}^{n \times n}$ is a non-negative stochastic matrix as described [7] and [9]. Later on in [5] and [10], the protocol has an alternate form of $X^{k+1} = DX^k$, where $D$ is also a stochastic matrix but may have negative entries, defined as the following:

$$D = \begin{bmatrix}
1 - \sum_{j \in \mathcal{N}_i} a_{ij} & \cdots & a_{in} \\
\vdots & \ddots & \vdots \\
a_{1i} & \cdots & 1 - \sum_{j \in \mathcal{N}_i} a_{ij} \\
\vdots & \vdots & \vdots \\
a_{ni} & \cdots & 1 - \sum_{j \in \mathcal{N}_i} a_{ij}
\end{bmatrix}$$

Where $a_{ij}$ is weighted entries of the adjacency matrix.

In order to conduct the stability analysis of the protocol, the matrix $P \in \mathbb{R}^{n \times n}$ or $D$ needs to satisfy the following conditions: 1. The sums of rows and columns are all ones; 2. The eigenvalues $|\lambda_i| < 1$, for $i = 2, \ldots, n$. Then by defining a positive definite Lyapunov function, it is proven in [5, 9, 10] that the protocol is asymptotically stable and they would reach a consensus value of the average initial value, which is $x_{eq} = 1/n \sum_{i=1}^{n} x_i^0$. However it would take too long to reach an exact consensus, therefore a terminating condition is usually required. For distributed computation, the terminating condition should also be a function of local values only. An example of such a condition is described in [10] $\sum_{i=k+1}^{\infty} |x_i^j - x_i^{j+1}| < \epsilon$, where $L$ is the number of consecutive iterations to investigate, and $\epsilon$ is a small number that represents the error.

Applications

There are many applications related to the consensus protocols, multi-agent coordination is particularly appealing and it attracts many researchers to investigate.
1. The key application we are looking at in this paper is Smart Grid, a digitally enabled electrical grid that gathers, distributes and transfers electricity intelligently. It consists of millions of automated electronic meters that will be connected to servers which manage the grid. It can achieve better reliability, better performance and more efficiency compared to a conventional grid which was still based on Tesla’s design in 1888. The largest existing Smart Grid is built in Italy, and brings an annual saving of 500 million euros[11]. The Smart Grid could collect global information distributedly using consensus protocols, and it is able to analyse the information in order to perform control actions, such as load shedding and load restoration.

2. Flocking is a naturally occurring phenomenon, also known as swarming behaviour in insects. Scientist and engineers have studied this type of behaviour and applied it in distributed sensing using mobile sensor networks, automated parallel delivery of payloads and performing military missions such as application in unmanned aerial vehicles (UAVs). There are three flocking rules introduced by Reynolds in [12]: 1. Flock centering, where individual vehicles attempt to stay close to nearby flock mates; 2. Collision avoidance, avoid collisions with nearby flock mates; 3. Velocity matching, attempt to match velocity with nearby flock mates. The role of consensus protocol is for an agent to achieve the matching velocity with respect to its neighbours. A relatively advanced protocol for flocking is described in [1]:

$$\dot{x}_i = u_i = \sum_{j \in N_i} \varphi(a(||q_j - q_i||)n_{ij} + \sum_{j \in N_i} a_{ij}(p_j(t) - p_i(t)) + f_i^q(q_i, p_i, q_r, p_r)$$

It can be easily spotted that the second term of the sum is a consensus term.

3. The synchronization of coupled oscillators attracts attention from many scientists in the field of biology to study networks of coupled neurons. Neural oscillation is a repetitive activity in the central nervous system. This process is driven by a mechanism located within individual neurons or by interaction between neurons. Their functionality is not yet fully understood, which make them even more interesting. One model of coupled oscillators on a graph is described in [13]

$$\dot{\theta}_i = \kappa \sum_{j \in N_i} \sin(\theta_j - \theta_i) + \omega_i$$

Where $\theta_i$ and $\omega_i$ are the phase and frequency of the $i^{th}$ oscillator. This dynamic is a nonlinear extension of the continuous consensus protocol.
Other applications include vehicle formation control, which can direct microsatellite clusters to form a precise space-telescope or a mapping-array; distributed sensor fusion in sensor networks, which is posing various distributed consensus to implement the Kalman filter [14], or a linear least-squares estimator.

**Coefficient setting methods**

By choosing a coefficient setting method, we can uniquely define the matrix $D$ in the updating scheme, which would be used in our simulation. There are a number of such methods. For a simple consensus protocol, the coefficient $a_{ij}$ in the equation is originally set by the Uniform method, where $N$ is the number of nodes during normal operation. It works optimally (can reach consensus in a single step) when the graph is complete.

\[
\text{Uniform Method: } a_{ij} = \begin{cases} 
\frac{1}{N} & v_j \in N_i \\
-\sum_{j \in N_i} \frac{1}{N} & i = j \\
0 & \text{otherwise}
\end{cases}
\]

However, there are rarely any complete graph topologies in real world applications, since the communication cost is too much. Later on, the Metropolis method was proposed in [15].

\[
\text{Metropolis Method: } a_{ij} = \begin{cases} 
\frac{1}{\max(N_i, N_j) + 1} & v_j \in N_i \\
-\sum_{j \in N_i} \frac{1}{\max(N_i, N_j) + 1} & i = j \\
0 & \text{otherwise}
\end{cases}
\]

It is verified that the Metropolis method could guarantee the convergence of information, while it adaptively configured the coefficient based on the information of local agents $v_i$ and $v_j$. This method shows some performance improvement compared to the Uniform method. Another improvement is the Mean Metropolis method proposed in [5]. This is based on the stability analysis of the consensus protocol with some modifications. In the stability analysis, we have the inequality $a_{ij} < \frac{2}{N_i + N_j}$ to guarantee the convergence. The convergence condition is satisfied by adding $\epsilon$, which is a small positive number to the denominator.

\[
\text{Mean Metropolis Method: } a_{ij} = \begin{cases} 
\frac{2}{N_i + N_j + \epsilon} & v_j \in N_i \\
-\sum_{j \in N_i} \frac{2}{N_i + N_j + \epsilon} & i = j \\
0 & \text{otherwise}
\end{cases}
\]

---

1 In this and the following sections, we let $N_i$ represent the number of first order neighbours for the $i^{th}$ node. $N^2_i$ represent the number of second order neighbours for the $i^{th}$ node.
[5] compared the performance of those coefficient setting methods, and it is shown that the Mean Metropolis method could achieve near optimal consensus speed. Inspired by the listed coefficient setting methods, we will propose a method involving second-order neighbour information.

The three methods described above are all distributed methods, such that the coefficient can be determined without any global information. There also exists a centralised method, called Particle Swarm Optimization (PSO)[16]. This method can obtain the optimal coefficient for a particular configuration, however it can only be implemented offline, requires global information, and can be time consuming, therefore should not be used in real-time applications. Nevertheless it can be used as a reference in the simulations to compare with other coefficient setting methods.

Proposal of the Coefficient Setting Method for Two-Hop consensus

![Graphs showing original, two-hop, and joint graphs](image)

Figure 1: (a) an undirected graph, (b) its Two-Hop graph, and (c) their Joint graph.

Fig 1 illustrates how the second-order neighbour could help increase the consensus speed. The two-hop graph (Fig 1a) consists of the second order neighbours’ connections for each node. For instance, node 1 has a second order neighbour of node 6 through node 5, and node 4 through node 2. A consensus protocol including the information of both first and second order neighbours would add a virtual two-hop graph to the original graph, and give the joint graph topology as shown in Fig 1c. As it can be seen, this graph has more connections and therefore a higher algebraic connectivity, which leads to a faster consensus speed. Note that one node can be both a first order neighbour and a second order neighbour; the information on that node will be used twice during consensus if this is the case.
It is known that the consensus protocol involving second order neighbours can effectively increase the consensus speed, in which [3] and [4] analysed the performance of such a protocol. However we cannot apply nearest neighbour coefficient setting method directly to the two-hop protocol, since the constraint on $a_{ij}$ is only derived for first order neighbour consensus. It can be easily verified that the Uniform method would guarantee the convergence, however it has fixed weights, which are proven to have a slower consensus speed compare to the adaptive coefficient setting method. Therefore we look for an adaptive coefficient setting method similar to the Metropolis method but involving the information from second order neighbours.

Murray and Jin described the two-hop protocol in [3] as the following:

$$x_i^{t+1} = x_i^t + \sum_{j \in N_i} a_{ij} (x_j^t - x_i^t) + \sum_{k \in N_i^2} w_{ik} (x_k^t - x_i^t)$$

**Adaptive coefficient setting method for two-hop consensus**

We propose the following two-hop consensus protocol inspired by the Metropolis and Mean Metropolis method, the proof of convergence of this protocol is provided in the Appendix.

$$x_i^{t+1} = x_i^t + \frac{1}{2} \sum_{j \in N_i} a_{ij} (x_j^t - x_i^t) + \frac{1}{2} \sum_{k \in N_i^2} w_{ik} (x_k^t - x_i^t)$$

where

$$a_{ij} = \begin{cases} 2\sqrt{2} & \text{if } v_j \in N_i \\ -\sum_{j \in N_i} \frac{2\sqrt{2}}{N_i + N_j + N_j^2 + N_j^2 - 1} & \text{if } i = j \\ 0 & \text{otherwise} \end{cases}$$

and

$$w_{ik} = \begin{cases} \sum_{j \in N_i} a_{ij} & \text{if } v_k \in N_i^2 \\ -\sum_{j \in N_i} \sum_{j \in N_i} a_{ij} a_{jk} & \text{if } i = k \\ 0 & \text{otherwise} \end{cases}$$

where $x_i^t, x_i^{t+1}$ represent the information of $i^{th}$ agent at $t^{th}$ and $(t+1)^{th}$ iteration respectively.

**Updating scheme**

We have mentioned that the discrete time first order neighbour protocol has a matrix representation of $X^{k+1} = DX^k$. The updating scheme for two-hop consensus is derived to be $X^{k+1} = (I + A' + 2W')X^k$, where $A'$ and $W'$ are the matrices corresponding to the second order coefficients.
An Investigation of the Adaptive Coefficient Setting Method

where \( a_{ij} = \frac{a_{ij}}{2}, w_{ik} = \frac{w_{ik}}{2} \) such that \( A = 2A', W = 2W' \)

This scheme is implemented in our simulation. The setting of our simulation is undirected fixed topology of linear average consensus protocol in discrete time. The marginal error at consensus is set to 1% of the average initial value of the nodes within the network, that is, the information collection process will terminate once the following inequality is satisfied:

\[
\sum_{i=1}^{n} |x_i^t - x_{i+1}^t| < 1\% \times \frac{1}{n} \sum_{i=1}^{n} x_i^0
\]

This error should be designed differently for other applications. Bearing in mind that in real world applications, the error function needs to be distributed, and should depend on the scale of initial values of nodes within the system. The smaller this error is, the longer the consensus time will be.

**Simulation results**

In the first part of the investigation, we look at how the graph topology affects the consensus speed, and from this, we suggest network layout for the power systems. It was shown that the algebraic connectivity \( |\lambda_2'| \) of graph laplacian reflects the consensus speed in [7]. In order to maximize the consensus speed, the updating protocol needs to be properly designed. [5] has shown that the Mean Metropolis method can achieve near optimal consensus speed, and the optimal speed can be obtained by designing a D with minimum second largest eigenvalue, denoted as \( |\lambda_2'| \). Therefore we will use the Mean Metropolis method to set the coefficients, with ideal epsilon found by Matlab such that \( |\lambda_2'| \) is minimized.

We have collected simulation results for tree, star, ring, two-hop and complete topologies, with number of nodes ranging from 6 up to 100.

<table>
<thead>
<tr>
<th>Number of nodes</th>
<th>Second Smallest Eigenvalue for Different Graph Topology</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Tree</td>
</tr>
<tr>
<td>6</td>
<td>0.8592</td>
</tr>
<tr>
<td>7</td>
<td>0.8937</td>
</tr>
<tr>
<td>8</td>
<td>0.9147</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>100</td>
<td>0.9957</td>
</tr>
<tr>
<td>Number of connections for N nodes</td>
<td>N − 1</td>
</tr>
</tbody>
</table>
We then repeatedly ran the simulations to compare the consensus speed of the first order neighbour protocol using the Metropolis method $X_{k+1} = DX_k$, with our proposed coefficient setting method for two-hop protocol $X_{k+1} = (I + A' + 2W')X_k$.

### Table 2: Comparison of Consensus Speed using Different Protocols

<table>
<thead>
<tr>
<th>Number of Nodes</th>
<th>Average Number of Connections per Node</th>
<th>Number of Iterations Required</th>
<th>Percentage Speed Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>0.86</td>
<td>82</td>
<td>128%</td>
</tr>
<tr>
<td>7</td>
<td>1.42</td>
<td>23</td>
<td>53%</td>
</tr>
<tr>
<td>15</td>
<td>0.93</td>
<td>338</td>
<td>67%</td>
</tr>
<tr>
<td>15</td>
<td>1.33</td>
<td>110</td>
<td>33%</td>
</tr>
<tr>
<td>30</td>
<td>0.97</td>
<td>1729</td>
<td>78%</td>
</tr>
<tr>
<td>30</td>
<td>1.33</td>
<td>193</td>
<td>30%</td>
</tr>
<tr>
<td>30</td>
<td>1.70</td>
<td>64</td>
<td>25%</td>
</tr>
<tr>
<td>60</td>
<td>0.98</td>
<td>4928</td>
<td>99%</td>
</tr>
<tr>
<td>60</td>
<td>1.30</td>
<td>501</td>
<td>47%</td>
</tr>
<tr>
<td>60</td>
<td>1.50</td>
<td>256</td>
<td>24%</td>
</tr>
</tbody>
</table>

### Discussion

There are many potential applications of consensus protocols; we will only focus on power system implementations. In power systems, once a fault node has been cleared, it is necessary to restore the out-of-service but un-faulted node as fast as possible to maintain supply, this is the load restoration process. Also if there is insufficient power generation within the system, it is necessary to intelligently shed some load in order to obtain demand-supply balance, this is the load shedding process. Both load restoration and load shedding processes require the application of consensus protocols in order to obtain the global information distributedly, including those that address which node has failed, which node has been affected and what is the net power of the system. By increasing the consensus speed, the power system will have a better performance and a faster response. There are two obvious factors that have a significant impact on the consensus speed: one is the graph topology, i.e. the layout of network agents; and the other is consensus protocol, i.e. how the consensus proceeds. We will therefore look at how to improve the consensus speed in those two ways.
The effect of graph topology

For each topology, the second largest eigenvalue of weighted graph laplacian is calculated. It can be easily observed in Table 1 that complete topology (Fig 2e) has the fastest consensus speed, each with an \( | \lambda_2 | \) almost zero. In fact, the system will reach consensus after one step for nodes number \( \geq 12 \). However, in real world power systems, building a connection between every pair of nodes to get a complete graph topology is not feasible.

Tree (Fig 2a), star (Fig 2b) and ring (Fig 2c) topologies for \( N \) nodes will have \( N-1 \), \( N-1 \) and \( N \) connections, respectively; while two-hop (Fig 2d) has \( 2N \) connections. Although two-hop topology has a faster consensus speed than tree and ring topology, in terms of connection-cost it appears to be inefficient. This topology also has a slower speed than star topology in large networks, therefore the two-hop topology may not be suitable in real world power systems.

Tree, star and ring topologies have almost the same number of connections for the same number of nodes. For smaller networks (less than 10 nodes), ring topology has the fastest speed, while star topology is more preferable in large networks. It was simulated that for a 100-node system, the time required to reach consensus for ring topology is ten times more than the time required for star topology. A possible explanation for such behaviour is that in a small network the distance between any pair of nodes in ring topology is short; while in large networks, the distance is too long. The advantage of star topology, on the other hand, is that the maximum distance between any pair of two nodes is two connections in length, and every other node is directly connected with a central node such that the nodes can communicate more efficiently.

It is important to note that the communication structure is independent of the physical infrastructure of Smart Grid or other power systems. The communication between two neighbouring nodes can still carry on even if the physical distribution line is disconnected. Therefore, the graph topologies discussed in this report refer to the communication structure and not the actual physical structures.
The effect of consensus protocol

Since the two-hop protocol is the equivalent of adding a virtual two-hop graph to the original graph, resulting in a joint graph, we simulate the consensus process for the joint graph but using first-order neighbour protocol. This simulation would keep the communication cost the same, as the controlled variable. Results show that the consensus speed for the joint graph using first order neighbour protocol is faster. However, it does not indicate that two-hop protocol is a bad choice. Since we have used the actual joint graph in the simulation, this means that there are more actual connections between nodes rather than the virtual connections in two-hop protocol, which would increase the infrastructure cost of the network.

The simulations were performed repeatedly to compare the consensus speed of first order neighbour protocol using the Metropolis method with our proposed coefficient setting method for two-hop protocol. Table 2 demonstrates that the increase in consensus speed varies under different graph topologies. There appears to be a trend such that the more connections there are, the less effective the two-hop protocol. An explanation for this trend is that if the original graph already has many connections, then the two-hop graph is only going to add fewer new connections, such that the increase in consensus speed is smaller. Nevertheless, we can see that from our simulation, there is a 24% to 128% increase in consensus speed by using our proposed protocol.

However, by involving a second-order neighbour into the consensus, extra information needs to be communicated between the agents through network connections. It was shown in [3] that the bandwidth requirement is doubled compare to the first order neighbour protocol. Also, employment of the two-hop protocol results in additional time delay in communication as the second order neighbours need to first pass their information to the first order neighbours.

Conclusion

We reviewed consensus protocols, some of their applications, and discussed different forms of existing protocols. Based on our Matlab simulation, we found that the star topology gives the fastest consensus speed for large networks with the consideration of communication cost. Ring and two-hop topologies have better performance for smaller networks. Complete graph un-doubtedly gave the fastest consensus speed, but the communication cost is extremely high. We slightly modified the original two-hop protocol and proposed an adaptive coefficient setting method inspired by the Metropolis method, verified its convergence and also derived the matrix form of the updating scheme for our
two-hop protocol. It is able to deliver a faster consensus speed and the simulation shows that the speed increased up to 100%. However there are some trade-offs of implementing the two-hop protocol, such as extra bandwidth requirement and communication time delay.

Our proposed adaptive coefficient setting method for two-hop protocol will increase the consensus speed, and save a large proportion of time during the consensus process. In the case of power systems such as Smart Grid, this will reduce the time taken for actions such as load restoration and load shedding, therefore saving power and increasing the overall efficiency of the system.

**Acknowledgement**

I would like to thank Jiahu Qin and Dr. Brad Yu for fruitful discussions and their advice on this project.

**Bibliography**


Appendix

Proof of Convergence for the Proposed Adaptive Coefficient Setting Method

\[ x_{i}^{t+1} = x_{i}^{t} + \frac{1}{2} \sum_{j \in N_{i}} a_{ij}(x_{j}^{t} - x_{i}^{t}) + \frac{1}{2} \sum_{k \in N_{i}} w_{ik}(x_{k}^{t} - x_{i}^{t}) \]  \hspace{1cm} (1)

where \( a_{ij} \) represents the information of the \( i \)-th agent at the \( t \)-th and \((t+1)\)-th iteration respectively.

We can multiply both sides of (1) by two and split it into (4) and (5):

\[ x_{i}^{t+1} = x_{i}^{t} + \sum_{j \in N_{i}} a_{ij}(x_{j}^{t} - x_{i}^{t}) \]  \hspace{1cm} (4)

\[ x_{i}^{t+1} = x_{i}^{t} + \sum_{k \in N_{i}} w_{ik}(x_{k}^{t} - x_{i}^{t}) \]  \hspace{1cm} (5)

It was shown in [5] that the stability of the first order neighbour consensus protocol can be guaranteed provided that

\[ 0 < a_{ij} < \frac{2}{(N_{i} + N_{j})} \]  \hspace{1cm} (6)

If we only consider the two-hop graph, then \( w_{ik} \) is also a weighted Laplacian for the same graph, we can conduct a stability analysis using exactly the same derivation in [5, 10], where by defining a Lyapunov function as the following \( V_{t} = (X_{t})^{T} X_{t}, \Delta V = V_{t+1} - V_{t} \) the stability can be guaranteed provided that:

\[ 0 < w_{ik} < \frac{2}{(N_{i} + N_{k})} \]  \hspace{1cm} (7)

In order for (1) to converge, we show both (4) and (5) converge individually, and as a result the sum of two convergence protocols also converge. We firstly show that the new \( a_{ij} \) satisfies condition (6), such that (4) will converge.
Secondly, we show that the new weight $w_{ik}$ satisfies (7) such that (5) will converge.

Since our proposed coefficients $a_{ij}$ and $w_{ik}$ satisfy the conditions (6) and (7) respectively, both (4) and (5) converge such that the overall protocol (1) will also converge.
Gender, Empire and the Church Missionary Society in British Uganda, 1895–1930

Jayne Regan

Abstract

The relationship between the British Empire and Christian missions in the colonial context was complex, and the degree to which missions and missionaries might be considered agents of empire contested. Examining Protestant Church Missionary Society (CMS) activity in British Uganda between 1895 and 1930, this article will argue that though missions generally had no official ties to empire, they can still be considered cultural imperialists. Moreover, it will be argued that gender was central to the relationship between missions and the imperial project. Domestic issues, such as marriage, household and personal cleanliness, child rearing and gender roles, were considered essential to the civilising process; the increasingly feminised CMS workforce in Uganda fought to abolish polygamy, physically transform the family home and ‘improve’ the social position of Ugandan women to more closely reflect a British model. Missionaries could not extricate Christianity from British national and imperial culture, and so propagated ideologies, particularly related to gender, that widened and deepened the effect of the British imperial project.

Take up the White Man’s burden –
Send forth the best ye breed –
Go bind your sons to exile
To serve your captives’ need;
To wait in heavy harness,
On fluttered folk and wild –
Your new-caught, sullen peoples,
Half-devil and half-child.

Rudyard Kipling, ‘The White Man’s Burden’.
Introduction

At the end of the nineteenth century India-born Englishman Rudyard Kipling encouraged Americans to, like the English, ‘take up the White Man’s burden’, to colonise the Philippines for the benefit of the ‘uncivilised’ local population. Kipling’s poem is illustrative of the common emphasis on the supposedly humanitarian nature of the imperial project. For Kipling it was the duty of Britain, and America, to bring religion, morality and civilisation to the ‘heathen’ people of the world.¹ Financial, material and territorial gains were probably greater motivators for empire,² yet it is also important to examine this apparently philanthropic element of the British imperial project, keeping in mind that philanthropy was generally considered synonymous with Christianity and religious missions in this period. While Kipling’s philanthropist is gendered male, in 1899 when the poem was published, Christian missions – the most prominent ‘philanthropic’ organisations in the colonial landscape – were undergoing a feminisation of their workforce. By examining the Church Missionary Society (CMS) in British-controlled Uganda between 1895 and 1930, this study interrogates the complicated relationships between Christian missions, the British Empire and gender, and argues that the goals of missions and missionaries were complimentary to empire.

This article is indebted to a variety of other studies that have explored the gendered nature of missionary work and the relationship between missions and the British imperial project. In The Gospel of Gentility: American Women Missionaries in Turn-of-the-Century China, Jane Hunter explores the role of gendered nature of missionary work in America’s informal Chinese empire, and Ulrike Sill’s Encounters in Quest of Christian Womanhood: the Basel Mission in pre- and early Colonial Ghana interrogates the relationship between empire, mission and gender in nineteenth century Ghana. In the Ugandan context, Holger Bernt Hansen has written extensively on the political relationship between missions and the colonial administration, and Carol Summers looks specifically at the Ugandan colonial administration and missionaries’ shared belief that polygamy directly led to syphilis. In Women Missionaries of the Church Missionary Society in Uganda 1896-1920, Louise Pirouet argues that female CMS missionaries held imperial beliefs that could influence their behaviour, but does not consider their significance as part of the wider imperial project. This article explores

both the gendered and imperial nature of the CMS in Uganda, and argues that the performance and promotion of ‘appropriate’ masculinities and femininities extended the effect of the British imperialism.

Three central arguments demonstrate that the CMS in Uganda can be considered an important, if unofficial, part of the wider British imperial project. First, the CMS recognised the need for a closer association with the British colonial administration, in part for its own security, but also because it was believed that a combination of ‘civilisation’, Christianity and economic development were necessary to abolish slavery and create economic and social stability in Africa so that it might continue to be an economically productive colonial site. Second, it was assumed that crucial to the success of this development and civilising process was a focus on ‘improving’ the position of Ugandan women and familial dynamics to better reflect the British model. Third, the attention given to these domestic issues of family and the role of women corresponded to a change in the composition of the CMS itself as women came to play a greater missionary role; though this generally went unacknowledged as the emphasis was placed on male missionaries who could be presented similarly to brave imperial heroes.

In 1895 the first CMS female missionaries arrived in Uganda, at a time when missionaries were at their most influential, holding an almost complete monopoly in education until the mid-1920s. With government intervention in education beginning after World War I, the British-based missionary influence in Uganda began to decline. While Catholic missionaries were an important part of the colonial landscape in Uganda, I will focus here – for reasons of the scope of this article and available evidence – on Protestant CMS missionaries and their letters, articles and published books and reminisces. This article reconstructs the British side of this colonial encounter; further research into the reactions and outlooks of colonised Ugandans would be extremely valuable. The bulk of my evidence comes from CMS missionaries who lived and worked in the kingdom of Buganda, the largest kingdom within Uganda, with peoples referred to as the Baganda.

Empire, Christianity and ‘civilisation’

The first Christian Protestant missionaries in Uganda, Lieutenant G. Shergold Smith and Reverend C. T. Wilson of the London-based CMS, arrived in the court of Kubaka Muteesa, King of Buganda, on 2 July 1877. This was eleven years before the Imperial British East Africa Company (IBEAC) received its Royal Charter and began to protect British interests in Uganda, and sixteen years
before the British government officially took direct responsibility for the region, declaring the Uganda Protectorate in 1894. By the early 1880s the CMS was performing baptisms and had established several mission stations in Buganda and other territories.\(^4\)

In July 1891 the chairman of the IBEAC, Sir William Mackinnon, informed the British Foreign Office that the Company would be withdrawing its forces from Uganda, it having become too expensive to continue work in the civil war-ravaged region.\(^5\) The first Bishop of Uganda, Alfred Tucker, became immediately concerned. Though CMS missionaries had ‘entered Uganda, carrying their lives in their hands, never looking for, never expecting, Government protection,’\(^6\) since IBEAC control Protestants had provided the company with political and military support. Tucker believed that the IBEAC withdrawal would see the region descend into violent chaos and that Protestants, missionaries and native converts alike, having fought under the IBEAC flag in the civil-war, would become immediate targets.\(^7\) Bishop Tucker spearheaded the campaign to keep the IBEAC in Uganda, appealing to a meeting of the Church Missionary Gleaners’ Union for donations to secure the Company’s presence at least until the end of 1892. He was successful, and within two weeks the Gleaner’s Union had raised £16 000 to donate to the IBEAC.\(^8\) The IBEAC reversed its decision and stayed until Uganda became a full protectorate of the British Crown in 1894. According to early CMS historian Eugene Stock, ‘Bishop Tucker always said that the Gleaners’ Union saved Uganda.’\(^9\) The use of the word ‘saved’ here is significant. According to Stock, Tucker had not only saved CMS missionaries and other Protestants from violence, but the region as a whole, suggesting British imperialism in combination with CMS presence was beneficial to the native population. The belief that the combination of Christian missionaries and British imperial control was not only complimentary, but often necessary for the good of colonised peoples, was not limited to the Ugandan context.

In 1857 David Livingstone, the immensely popular British missionary-explorer to Africa, made the connection between the missionary movement and the British imperial exercise when he declared that it was his goal in Africa to ‘make an open path for commerce and Christianity.’\(^10\) Historian Brian Stanley rightly points out that this association was not purely an unashamed linkage between Christianity and British commercial expansion; rather it was the expression


\(^7\) Stanley, *The Bible and the Flag*, 128.

\(^8\) Ibid., 129.


\(^10\) David Livingstone in Stanley, *The Bible and the Flag*, 70.
of Livingstone’s conviction that a partnership between missionary work and ‘legitimate’ trade would drive out the slave trade, under which many thousands of Africans were suffering. Bishop Samuel Wilberforce more explicitly made the connection between Christianity and British commerce:

Was it not meant that God had given us our commerce and our naval supremacy - that industry, that patience which had enabled us to subdue the earth wherever we had settled...our wealth, with our mutual trust in each other, that we might as the crowning work of all these blessings, be the instruments of spreading the truths of the Gospel from one end of the earth to the other?

Wilberforce made it clear that while no suitable local form of economy might replace a system of slavery, British commerce, naval supremacy and industry had the capacity to make for the most effective dissemination of Christianity. The apparently beneficial combination of British economic control and Christianity is reflected in Stock’s belief that Tucker ‘saved’ Uganda by securing the IBEAC presence.

Many, like Livingstone, Wilberforce and Stock believed that the combination of commerce and Christianity could be beneficial to the native populations of Africa. However, this is not to suggest that the imperial project was a benevolent one, or, as Stanley does, that the connection between commerce and Christianity was purely ‘anti-slavery ideology.’ The British were not simply interested in the abolition of slavery; the connection between commerce and Christianity also provided moral justification for the British Empire to continue to ‘subdue the earth’ for its own economic benefit. Moreover, by promoting Christianity and the adoption of other ‘civilised’ British customs, the imperial project might have benefited through greater cooperation between colonisers and the colonised. Promoting commerce, Christianity and civilisation helped foster economic and social stability and conformity so that Africa might continue to be an economically productive colonial site.

Whether for humanitarian or exploitative purposes, teaching ‘civilisation’, which included civilised Christian religion, was an important feature of empire. Gender, particularly the role of women, was central to this British notion of civilisation. According to Mary Taylor Huber and Nancy Lutkehaus, Europeans saw the ‘proper’ division of gender as essential to their civilised imperial and national culture, and colonial Europeans were particularly concerned with

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11 Stanley, The Bible and the Flag, 70-71.
13 Stanley, The Bible and the Flag, 71.
‘doing gender right.’ Missionaries were dedicated to the civilised division of gender, both in the way they conducted themselves and in the way that they attempted to change the behaviour of colonised people.

Performing and representing gender in the missionary profession

As a part of ‘doing gender right’ the associated public-private division of spheres of action and responsibility were applied to CMS missionaries; male missionaries were considered leaders and preachers, women were delegated more domestic duties. Women were often considered lay missionaries, or missionary’s assistants, rather than missionaries in their own right and were often expected to take orders from male missionaries. Their work was considered supplementary to the central work of male missionaries; missionary wives were considered primarily a ‘helpmeet’ to their husbands. While CMS recruitment advertised the need for ‘men to organise and train and shepherd the flock’, women were only required for ‘women’s work’, which suggests more domestic activities. Certainly women’s missionary work was valued by the CMS; they assumed women were the most appropriate instructors for African women and children, and believed a white female presence would ensure the morality of missionary men who might otherwise be tempted into sin with heathen women. However, the work of men was predominant in the journals, accounts and recollections of CMS missionaries in Uganda.

Travelling through Uganda, John Bremner Purvis described the heroic work of legendary CMS missionary Dr A. R. Cook who ‘worked day and night…to alleviate the terrible sufferings’ of a number of Protestant Baganda involved in a bloody conflict with Muslims in the region. Purvis does mention that Cook was ‘ably assisted by the mission Ladies’; however, these women, who must also have been working night and day, remain nameless. Nameless too is a Protestant Baganda woman, even though Purvis considered her actions one of the most ‘striking instance[s] of self-sacrifice…in the world’s history.’ The intersection

16 Georgina Anne Gollock, Missionaries at Work (London: Church Missionary Society, 1898) 133.
20 Ibid., 198.
of racial and gender hierarchies meant that such women, no matter how heroic, were even less likely than white female missionaries to be described by name and more likely to be described simply as a ‘bible woman’ or ‘a woman teacher.’

Published CMS literature preferred to marginalise women and emphasise the masculine missionary hero, a figure who was intimately linked with the British national and imperial culture which emphasised masculinity, war, danger, exploration and adventure.

British masculinity in the imperial setting was defined by physical endurance, self-denial and self-sacrifice in dangerous and exotic locations. Missionary men, despite the intended religious focus also got caught up in the excitement and grandeur of heroic imperial adventure. ‘Muscular Christianity’ enabled the imperial ideology of masculinity to comfortably include religion; moreover, the Christianity of physically strong, adventurous imperial men actually functioned as a marker of civilisation. Christianity and morality refined and made gentlemanly the British man, and were used as justification for authority over the ‘barbarous’ native.

Missionary David Livingstone, becoming disenchanted with the stationary life of a missionary in Africa, set out in 1852 on the first of his major exploratory journeys, which he would continue for the next 18 years. As noted above Livingstone was the most influential religious-crusader-cum-imperial-adventurer of the period. British popular culture cast Livingstone as a ‘single minded Christian hero’, with an ‘iron will’ who navigated the ‘hostile and inhospitable country’ and people of Africa. Like other imperial adventurers he discovered and named many ‘unknown lands’ and environmental features, experiencing close scrapes with aggressive exotic animals, most famously with ‘the largest lion [the Bakatta people] had ever seen.’ Livingstone was the embodiment of the ‘muscular Christian’, and was propelled to the status of imperial hero. Given the often harsh conditions and exotic locations in which missionary work was carried out, missionary men could comfortably be presented in a similar way to imperial adventurers and explorers. The emphasis on the work and importance of male missionaries, both in the CMS literature and the celebrity surrounding David Livingstone actually masked the reality that by the end of the nineteenth century the missionary profession was becoming increasingly feminised.

The CMS, like other Protestant missionary groups, was male-dominated in terms of administrative hierarchies and organisational control. Additionally, women

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21 Ibid., 198.
22 Johnson, Missionary Writing and Empire, 40-41.
23 Ibid., 40.
25 Ibid., 218.
27 Ibid., 62.
were marginalised by the patriarchal administration, male-dominated official literature and mission historiography which tended to emphasise theological and policy issues, from which women were generally excluded. In terms of numbers, however, the missionary enterprise was an increasingly feminised profession; the mid to late nineteenth century saw a world-wide and cross-organisational increase in the number of female missionaries. Accurate numbers of women missionaries are almost impossible to gauge, particularly as missionaries’ wives were not counted or recognised in any official capacity by mission organisations, a practice which historian Jeffrey Cox believes has completely distorted the true nature of the missionary enterprise. From the mid to end of the nineteenth century the presence of women in some mission societies grew from virtually zero to over fifty per cent, as single female missionaries began to be accepted by mission societies.

White female missionaries did not arrive in Uganda until quite late in comparison with other areas of the British Empire. The CMS refused to allow female missionaries into Uganda until the 1895 British declaration of the Uganda Protectorate; only with official British colonisation was the region deemed safe for CMS women. Regardless of the delayed arrival of female missionaries, the situation of the CMS in Uganda certainly reflects the wider feminisation of the mission enterprise. In 1905, despite men having had an eighteen-year head start, women already made up twenty eight per cent of the official CMS workforce serving in Uganda. Additionally, of all new missionaries to arrive in Uganda between 1895 and 1905, forty four per cent were women. Of course, due to the practice of ‘not counting the wives’, these statistics do not take into consideration any missionary wives who arrived in Uganda after 1895; in reality the female missionary presence in Uganda would have been much greater.

The preoccupation with the civilised performance of gender, and the opportunity to emphasise heroic images of men in the imperial landscape, meant that the contribution of the increasingly female CMS workforce went largely unacknowledged. Civilised gender relations, however, were not just performed: they were taught. ‘Doing gender right’ was crucial to fostering a British notion of civilisation in the Ugandan population, and the increasingly feminised CMS workforce focused on Westernising marriage, familial dynamics and the gendered division of labour.

30 J. D. Mullins, *The Wonderful Story of Uganda by the Rev. J.D. Mullins; to which is added the story of Ham Mukasa, told by himself* (London: Church Missionary Society, 1904) 91.
31 These figures are derived from lists of all missionaries who served in Uganda in Mullins, *The Wonderful Story of Uganda*, 231-234.
32 Ibid.
Civilised gender and cultural imperialism

Much of the missionary project was concerned with encouraging the adoption of specific forms of marriage, family structure, gendered division of labour and child rearing. CMS missionaries believed these, along with ‘improving’ the position of Ugandan women, were considered essential to the civilising process, which – as has been noted – was believed to bring economic and social benefits for African populations, but probably more importantly to the British imperial project. Much of the work of the increasing number of missionary women was specifically aimed at improving the station of native women and enabling them to assume ‘correct’ gender roles.

According to prolific CMS missionary writer Georgina Anne Gollock, ‘the moral difference between Christian and non-Christian lands is seen more clearly when the position of women is faced.’ The belief that women in foreign lands, particularly Africa, lived in a state of degradation, overworked and abused by men, was common. The position of women in society was considered a marker of civilisation and the supposed equality of British women was used to argue the advanced stage of British civilisation. According to early CMS missionary to Uganda, Ruth Fisher, all Ugandan women were treated abysmally by men, despite distinct regional and tribal differences in the position of women. Fisher describes farming Baganda women as ‘slaves’ who are expected to ‘do the cultivating and cooking of the food.’ The notion of Baganda women farmers was particularly displeasing to many missionaries who believed this to be evidence of incorrect assignment of gender roles. According to them farming was a job that should have been carried out by men, and work in the fields was contributing to Uganda’s ‘lost womanhood.’

In the eyes of missionaries, polygamy was the ultimate system of male oppression, and they firmly believed that monogamous, Christian, companionate marriage was the most effective way to improve and make more domestic the position of Ugandan women. According to missionaries polygamy promoted gender inequality and was evidence of the immorality of non-Christian Ugandans. Carol Summers explores the way missions and colonial administrators made an association between polygamy, syphilis and supposed immorality in the early

34 Gollock, Missionaries at Work, 43.
37 Ibid., 71.
twentieth century. Summers argues that from 1907 to 1924 the Ugandan colonial administration grew increasingly concerned about low fertility and high rates of infant mortality attributable to sexually transmitted diseases (STDs), which they believed threatened the future of the Ugandan population. Missionary doctor A. R. Cook claimed that the majority of syphilis sufferers in Uganda had ‘fallen ill through immorality.’ To combat the epidemic of STDs the colonial administration, in close association with missionaries, developed a range of institutions and ideologies, essentially designed to ‘promote the family as a unit of reproduction and to reform motherhood.’ For the British missionaries and colonial administrators alike, it was the monogamous, nuclear family that would save Uganda, and presumably provide a more efficient, effective and stable male workforce for colonialism.

CMS missionaries promoted European ideas in regard to marriage, family and gender roles; yet they sometimes went much further than this. The CMS brand of Christianity was inextricably linked to British cultural ideas, and this meant that missionaries also endorsed many related, but more tangible, changes. Missionaries made a connection between ‘poor’ housing and immorality and lack of family life: improved physical dwellings were considered indicators of moral and religious development. For travelling missionary Isobel Barbour the Kraal, a Ugandan settlement made up of huts, was directly associated with ‘heathen Africa’; Christian Ugandans no longer resided in these sorts of communities and dwellings. Katherine Muller also illustrates the way in which the physical space of the Kraal was directly associated with heathenism and immorality; she claimed that the inside of family huts were filled with ‘darkness and superstition and ignorance.’ Missionaries advocated new physical spaces which would better accommodate a nuclear family, for example larger huts would enable children to sleep in the family home, rather than in communal dormitory-like huts for children. A monogamous, nuclear family, modelled on the British archetype, needed a physical home that went at least some way to resembling the ideal British one. Similarly, Ugandan dress, hygiene and bodies also needed to be altered to reflect a Christian lifestyle.

Christianity and morality were closely linked to appearance, and, as a result, missionaries encouraged particular hygiene and dress habits. Barbour describes

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44 Oliver, The Missionary Factor in East Africa, 64.
the missionary struggle to ‘get the women into cotton dresses...because they wash and skins do not’, though she was pleased that Ugandans were increasingly interested in using soap. Barbour also describes cleanliness inspections at a school for girls, where students who were deemed suitably clean were entitled to wear a school frock for the day. Fisher describes a similar practice, whereby clean schoolgirls were given dolls. Missionaries encouraged British dress and appearance conventions, and rewarded those who complied with British gifts, and, in these two cases, the gifts further emphasised missionary ideas about appropriate gender roles.

Missionaries also sought to change African bodies, particularly female ones. Most obviously they wanted Ugandan women to be slimmer, and to better reflect British ideals of beauty. Several white judges of a Ugandan beauty contest, including Barbour, projected their own ideas about female beauty on the Ugandan contestants. Barbour believed that in the eyes of the natives the judging panel had made the incorrect choice, having chosen a ‘modest looking girl’ over the ‘bulk and prominence’ of other contestants. Furthermore, Christianity itself supposedly had the ability to drastically change the female body. Katherine Muller’s short story A Princess of the Cattle Kraal follows the young Ugandan princess Muhindi’s conversion to Christianity and time spent in a missionary boarding school. Two female missionaries remove Muhindi from her home, hoping that a new generation of girls will leave behind old traditions. Two years of Christian boarding school ensures that, unlike her older sister, Muhundi is able to grow into a ‘tall, slim, graceful girl.’ Ruth Fisher believed Christianity was able to make some even more revolutionary physical changes, as a Ugandan woman’s ‘scarred face’ becomes ‘quite attractive’ following conversion.

Fisher argued that Christianity:

> is raising [Ugandan] women from their depths of degradation and beautifying their lives, cleansing and refining their speech and habits. Clean, tidy homes are now seen, and carefully cultivated land in place of the pestilential filth and gaunt elephant grass. Happy family life is springing up among the people.

Fisher made it quite clear that missionaries did not only seek to promote their particular brand of morality, but believed that morality, physical appearance,
environment and gender were all intimately related. The Christian restructure of Ugandan society was not only a moral and religious one; it meant the literal restructure of homes and the transformation of physical appearance based on a British model. These restructures and transformations were almost always aimed at women, girls and domestic spaces; to civilise missionaries felt they needed to target, elevate and refine Ugandan womanhood. Thomas Beidelman argues

Christian missions represent the most naïve and ethnocentric, and therefore the most thorough-going, facet of colonial life. Administrators and planters aimed at limited ends such as order, taxation, profits, cheap labour, and advantages against competing Europeans; and in that quest they sometimes attempted psychic domination as well. Missionaries invariably aimed at overall changes in the beliefs and actions of native peoples, at colonisation of heart and mind as well as body. Pursuing this sustained policy of change, missionaries demonstrated a more radical and morally intense commitment to rule than political administrators or businessmen.52

This is probably too harsh a judgement, and an over-simplification of colonial relations; Beidelman, however, convincingly argues that missionaries played an important role in the colonisation process, as colonisers of everyday life and purveyors of British moral beliefs. Though often not linked to the British imperial enterprise in any official capacity, missionaries were, at the very least cultural imperialists, whose actions helped to further the imperial cause.

Conclusion

The relationship between the Ugandan colonial administration and the CMS was by no means always harmonious; missionaries often came into conflict with the administration or objected to certain elements of the colonial enterprise. Missionaries were critical of the Ugandan Railway, believing it to be a source of temptation for local men, and partly responsible for the spread of immorality and venereal disease.53 Bishop Tucker also fought hard against the colonial administration on several occasions, particularly in regard to the administration’s introduction of a Marriage Ordinance in 1902-3 and later against the policy of forced labour, called kasanva.54 On the other hand, as we have seen, Tucker organised for CMS supporters to pay to sustain the IBEAC presence in Uganda.

53 Purvis, Through Uganda to Mount Elgon, 90 and 200-1.
54 For an analysis of the relationship between the CMS, Tucker and the Marriage Ordinance see Hansen, Mission, Church and State in a Colonial Setting: Uganda 1890-1925, 260-69; and for an analysis of the
Though missionaries did not always agree with specific policies or practices of the colonial administration, ultimately they supported the co-existence of empire and the missionary enterprise.

Though popular and CMS literature would have us believe that heroic male missionaries were shouldering ‘the white man’s burden’ in Uganda, in fact an increasingly feminised missionary organisation was undertaking work with a particularly domestic focus. Since gender was central to British ideas about civilisation and national and imperial identity, missionaries made it their duty to elevate the position of Ugandan women, and to spread particular ideas in regards to family, women’s work and marriage. Though not official agents of empire in the same way as colonial administrators, missionaries directly associated Christianity with British national and imperial culture, and propagated ideologies, particularly related to gender, that extended and deepened the effect of the British imperial project.

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Lost in the Struggle: Aussie Battlers in the Rhetoric of Opposition

Joshua Bee

Abstract

This essay examines the role of the Aussie Battler in Australian political rhetoric. I argue that the Aussie Battler is a rhetorical incarnation of economic struggle, in which an Opposition utilises an ambiguity akin to dog whistling to foment and direct dissatisfaction towards an incumbent Government. Concepts like these are necessarily self-limiting after the Opposition deploying them is elected, as the circumstances from which they arise directly conflict with the expected rhetoric of competent and effective Government. Whilst particular incarnations of this rhetoric may hold partisan connotations, for instance Howard’s Battlers or Rudd’s Working Families, the pool of discontent they seek to foment and mobilise remains largely consistent. Curiously, this ongoing manipulation and promise of representation seems to undermine the essence of the Battler cultural ethic that makes identification with such articulations rhetorically significant.

Introduction

In 1988 John Howard, as Leader of the Opposition, gave a speech designed to foster a sense of disjuncture between the Government, and Australians who felt that - for a reason that perhaps was not entirely clear - life was harder than it should be. Over the next eight years, a shadowy horde of Aussie Battlers banded together against an elitist Government that was ‘out of touch’, and in 1996, ‘Howard’s Battlers’ were widely credited with delivering Australia its first Liberal Government in over a decade. Whilst their significance as a construct necessarily diminished during the Howard years, the pool of potentialities from which the Aussie Battler arose remained. In the lead up to the 2007 election, this pool of alienation and struggle was reincarnated by Labor under Kevin Rudd, challenging Howard’s incumbency on behalf of the ‘Working Families’.


This essay will argue that the ‘Aussie Battler’ is a rhetorical incarnation of economic struggle, in which an Opposition utilises an ambiguity akin to dog whistling to foment and direct dissatisfaction towards an incumbent Government. Concepts like these are necessarily self-limiting once the Opposition deploying them is elected, as the circumstances from which they arise directly conflict with the expected rhetoric of competent and effective Government. Therefore, the ‘Aussie Battler’ is primarily a rhetorical tool for attacking incumbency, and can be reworked and deployed against its former masters, as illustrated by the rise of Labor’s ‘Working Families’ and the downfall of the Howard Government.

Identification through economic struggle

‘Aussie Battlers’ and ‘Working Families’ can both be seen as rhetorical incarnations of economic struggle, intended to draw a wide and ambiguously defined identity. Examining Howard’s speech in 1988, the identity is broadly bordered by two conceptions. The first pillar of battler identity is a perceived struggle to make ends meet, particularly as a result of interest rates and the cost of living (e.g. groceries, transport etc.).

Is [Keating] so out of touch that he does not recognise that in March 1983, when he became Treasurer of this country, the average family had to set aside 19.7 per cent of its weekly income to pay off its home and it now has to set aside 27.7 per cent of its weekly income to pay off its home? Is he so out of touch that he does not realise that in March 1983 an average wage earner had to work 33 weeks to buy the Australian family car and now has to work 49 weeks to buy that same family car?... If any of them dared to go into the supermarkets of Australia...they would find that the people in those parts of Australia know that family living standards have fallen.3

The terminology used in the construction of this identity has significant parallels with dog whistle politics, in that the use of ambiguous but culturally positive language makes the identity accessible to voters who may otherwise be split along various demographic lines.4 Dog whistling refers to the use of ambiguous, ‘coded’ words, to alter the impact a statement will have on different audiences, whilst minimising negative ramifications for the speaker.5 As Fear argues, the language chosen seeks to “enlighten a select audience while keeping

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3 Howard (1988), Parliamentary Debates.
5 Ibid.
The rhetoric of the ‘Aussie Battler’ or the ‘Working Family’ utilises a comparative ambiguity, which appeals to a much wider audience than would be the case if the identity was forged around explicit demographic markers.  

The term ‘Aussie Battler’ refers to an individual who represents a quintessentially Australian stoicism and determination. In a harsh landscape, the Aussie Battler struggles without pretention, and in so doing is glorified in the Australian psyche. As has been seen above, Howard’s Aussie Battlers’ landscape is one defined primarily, though not exclusively, by economic hardship. The cultural significance of this framing and the ambiguous borders of its potential membership encourage a broad audience to find resonance in the identity, despite vastly different economic circumstances.

This is illustrated most succinctly by the rise of the pejorative “middle-class battler” in academia, describing those who feel they are struggling to subsist, whilst in fact they are relatively well off. However, by deliberately defining ‘Aussie Battlers’ and ‘Working Families’ in broad terms rather than strict social markers - as those who feel pressured by interest rates or as those who now have to pay more for a ‘family car’ - speakers such as Howard are able to tie together a markedly diverse populace. Having done so, this perceived struggle is defined as a consequence of the actions of an out of touch and elitist Government, thereby creating the second pillar of Battler identity.

The Government as the antagonist

Whilst the rhetorical victims are drawn broadly, the antagonist is narrowly defined as the Government, and an ambiguity akin to dog whistling is employed to covertly amplify its disjuncture with the audience. This is illustrated in Howard’s speech by aggrandising the Government’s role in setting interest rates relative to the Reserve Bank.

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6 (Emphasis original) Ibid.
7 Whilst I shall not examine coding in detail here, it is not unreasonable to assume that these terms may have a particular meaning for certain segments of the community that may vary with the assumptions held by the audience. For instance, Aussie Battler may have particular connotations for those concerned about immigration, and Working Families may have particular connotations for social conservatives, particularly in a period when same-sex marriage was gaining increasing exposure.
As this debate commences, the drover’s dog is winging his way overseas and the clink of the first-class drinks trolley can be heard... if the Treasurer dared to jump out from behind the tinted glass of his Sydney car, if he dared to go back to Bankstown – and I doubt whether he could get there without the aid of a Gregory’s street directory – they would find that the people in those parts of Australia know that family living standards have fallen...interest rates will go up as a result of the economic policies of this Government.10

Depending on the preoccupations of the listener, his descriptions of the Government’s overseas engagement - and of Keating behind the “tinted glass of his Sydney car”- may appeal, as Greenfield and Williams argue, to the resentment of “cosmopolitan new class elites” amongst sections of the community in the period.11 It may also appeal to the notion of a wasteful Government, or just come across as a simple taunt, inconspicuous in the back and forth of daily politics to those who cannot otherwise relate to the concerns of the Opposition. Alienation from the incumbent Government was fomented by Rudd’s 2007 campaign in a similar fashion. By subtly commenting on Howard’s opportunities and rhetoric to suggest he only had the interests of his friends, big business, and mining companies at heart as opposed to ‘Working Families’, whilst ostensibly merely highlighting that he has ‘lost touch’, Rudd was able to create a level of unity whilst still capitalising on potentially divisive issues amongst sympathetic listeners.12 The pivotal role this sense of alienation plays in the formulation of ‘Aussie Battlers’ characterises the concept as a tool of the Opposition.

Demise and reincarnation

The shelf-life of a particular incarnation of the ‘Aussie Battler’ is limited as the circumstances from which it arises directly conflict with the expected rhetoric of competent and effective Government. As Dyrenfurth argues, Battlers should not be battling long after their champion has been elected.13 That both Governments and Oppositions are aware of this fact is illustrated by an examination of the invocation of ‘Aussie Battlers’ and ‘Working Families’ in the Parliament. The following data was retrieved from analyses of online Parliamentary

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Lost in the Struggle: Aussie Battlers in the Rhetoric of Opposition

Collections, and is presented in Table 1.14 From 1990 to the change of Government in 1996, there was a fourfold increase in the invocation of the ‘Aussie Battler’ by the Liberal Party compared to the prior two Parliaments, sitting from 1985 to 1990. Whilst Labor’s use of the term also increased notably in 1995, this is primarily in an attempt to refute the Opposition’s rhetoric, and, as Senator Jacinta Collins argued, to give “a much fairer comparison of where Australia stands with respect to its treatment of the Aussie battler”.15 A comparable increase occurs with ‘Working Families’ in the lead up to the 2007 election which resulted in a change from the Howard to the Rudd Government.

The two Parliaments preceding the change of Government, sitting from 2002 to 2007, saw a dramatic increase in Labor’s invocation of ‘Working Families’ when compared to the two previous, sitting from 1996 to 2001. As per Table 1, preceding the change of Government, Labor’s invocations rose from an average of 59 per year from 1996 to 2001, to 157 in 2002-2004, and then 303 in 2004-2007. What both the Howard and the Rudd change of Governments illustrate is a general trend in which rhetoric surrounding economic struggle increases directly in the lead up to and immediately following instances of change. These figures also demonstrate that the rhetoric of economic struggle may quickly become a liability for a new Government.

Following Howard’s victory - particularly noticeable in the 39th and 41st Parliaments (1998-2001 and 2004-2007 respectively) - most references to the Liberal’s ‘Aussie Battlers’ were made by Labor, whereas the Liberal Party’s invocation returned quickly to their pre-rise levels. This trend appears to be recurring following the 2007 change of Government. As shown in Table 1, the Liberal Party’s invocation of ‘Working Families’ rose from 55 instances in 2004-2007, to 481 instances in 2008-2010. Labor’s use of the term also rose dramatically in 2008-2010. Research into the causes of this rise warrant deeper examination than can be provided here, particularly given the leadership challenge that occurred during this period. However, following this rise, Labor’s invocation of ‘Working Families’ in the current Parliament under Gillard has again dropped, with just under half of all references having been made by the Opposition.16 Whilst it remains to be seen whether the figures remain stable, this supports the theory of the limited shelf-life of ‘Working Families’ in Government. A comparison of Howard’s rhetoric in 1988 with that utilised by the Labor

14 All data was retrieved from the Parliamentary Collections online search engine, limiting results to the House of Representatives and the Senate: http://parlinfo.aph.gov.au/parlinfo/search/search.w3p;adv=yes There is some discrepancy in the results between the total number of debates mentioning the term ‘Working Families’ and the recorded usage by party.
16 As of 25/4/2012, there were 130 Opposition references compared to 167 by the Government.
Party in 2007 supports the notion that that particular identities, such as ‘Aussie Battlers’ and ‘Working Families’ are in fact rhetorical incarnations arising from largely the same pool of potentialities.

**Working families are Aussie Battlers**

In 2007, Labor released a series of ads seizing on Howard’s declaration that “Working families in Australia have never been better off”. Decrying high interests rates, costs of living, and employment conditions, ‘Working Families’ emphasised that Howard had lost touch with the experiences of the wider community:

> My child care and grocery prices are higher than ever, we’re working longer and harder under Work Choices, and those interest rate rises, they’ve stretched us to the limit. Imagining these kids owning their own homes is just a joke. Never better off? You’ve lost touch Mr Howard. No offence, but you’ve just been there too long.

If one was to strip the explicit mention of Work Choices, any façade of distinction between Aussie Battlers and Working Families is lost when trying to determine the target of the mocking derision: “our priorities are right; there is nothing to worry about”. The 2007 campaign is a near replica to the appeal to interest rates, cost of living, and alienation – particularly as a result of the length of incumbency, which Howard made in 1988:

> The reality is that this Government has been in power so long that it has grown arrogant and indifferent. It has lost touch with ordinary Australians and increasingly it has no idea of the life and the circumstances of average families.

Arguably what this indicates is that, whilst particular incarnations such as ‘Aussie Battlers’ or ‘Working Families’ may have partisan connotations, these identities are in fact activated through a rhetoric which is fundamentally based on a common sense of economic alienation from Government. As such, these incarnations must primarily be seen as a rhetorical tool for attacking incumbency, which may reforged and deployed against its former masters.

In all, this appears to paint a rather bleak picture for the future of ‘Aussie Battlers’. Implicit in all of the appeals to champion their cause is the notion

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18 Australian Labor Party, “Really Mr Howard?”.
20 ibid.
that they should not be struggling, and the promise of easier days under a new Government. The difficulty of delivering such a promise - having cast the identity so wide - is that it is more or less inevitable that a significant portion of the diverse population rallied will be disappointed, a new sense of alienation will accrete, and the cycle will continue. The quintessentially Aussie Battler who struggles without pretention, and in so doing is glorified in the Australian psyche,\textsuperscript{21} has, in a sense, become lost in the struggle of the ‘Aussie Battler’. Whereas such an identity previously provided a level of introspective comfort in the face of the harsh realities of economic survival, it remains to be seen whether or not Australians will be able to arrive at a level of contentment without addressing the political manipulation of their material circumstances.

References


Table 1: Mention of ‘Aussie Battler’ and ‘Working Families’ in Parliament

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The Impact of Microplastics on Salp Feeding in the Tropical Pacific

Wing Y. Chan and Jan Witting

1. Abstract

While phytoplankton remove atmospheric CO₂ through photosynthesis, salp (filter-feeding pelagic tunicates) feed on them and transport this newly-fixed carbon to the deep ocean via their fast-sinking fecal pellets. For this reason, the feeding activities of salp are important to the carbon cycle. However, the discovery of the Great Pacific Garbage Patch has raised concerns regarding the effects of plastics on marine organisms. Specifically, although the impact of macroplastics on marine mammals has been well-documented, the impact of microplastics on filter-feeders has yet to be investigated.

This marks the first study to examine the impact of microplastics on salp feeding using fluorescent polyethylene microspheres in a series of feeding experiments under controlled conditions. Results indicate that larger-sized salp (i.e. ≥ 3 cm) are vulnerable to microplastics ingestion at a high microplastic concentration (i.e. 4.2 microspheres/ml), while smaller-sized salp (i.e. < 3 cm) are more vulnerable to the clogging of their feeding apparatus at medium to high microplastic concentrations (i.e. 3.2 and 4.2 microspheres/ml).

Keywords: Salp, Feeding, Microplastics, Fluorescent Polyethylene Microspheres

2. Introduction

Phytoplankton grazers (e.g. krill and salp) are important to the carbon cycle as they package and transfer the CO₂ fixed by phytoplankton to the deep ocean via their fecal pellets. This process of downward carbon flux is crucial to the maintenance of a steady atmospheric CO₂ level. Specifically, salp are one of the most efficient carbon packagers in the biological pump (Fortier et al., 1994). This is because their fecal pellets have a relatively higher carbon content and a faster sinking rate (i.e. ~400-900 m/day) than other major grazers such as krill and pteropods (Ramaswamy et al., 2005). During a phytoplankton bloom in the Southern Ocean in 1994, salp were estimated to be able to export up to
88mg of carbon/ m²/ day to the deep ocean (Pakhomov & Pakhomov, 1998). In addition, diel vertical migration of some salp species also helps to accelerate this downward carbon flux (Nishikawa & Tsuda, 2001).

Since the discovery of the Great Pacific Garbage Patch (a 700,000 km² region of floating plastic debris in the North Pacific Ocean) by Capt. Charles Moore in 1997, the issue of marine plastics has received considerable scientific attention (Kaiser, 2010). Much research has been done since then on the impact of macroplastics on marine mammals, and ~100,000 marine mammals are estimated to die each year due to plastic ingestion or entanglement in the North Pacific Ocean (Moore et al., 2001). The effect of microplastics (i.e. plastics < 5 mm) on filter-feeders such as salp, however, has not been investigated (Thompson et al., 2004). To date, only one study has documented the embedment of microplastics in the body of one salp (Moore et al., 2001). Since macroplastics disintegrate into microplastics over time, the amount of microplastics in the ocean is likely to increase in the future, as well as their negative impacts on pelagic filter-feeders (Doyle et al., 2010).

The design of the feeding mechanism of pelagic filter-feeders like salp renders these animals particularly vulnerable to marine microplastics for two reasons. Firstly, salp are unlikely to be able to distinguish between microplastics and their real prey. Salp feed by filtering particles through their mucous net – a net that is continuously secreted in their pharyngeal chamber (Harbison & McAlister, 1979). When salp swim through the water column, they contract their circular muscle bands to allow water to enter their oral opening, and to pass through the meshes of their mucous net (Sutherland et al., 2010) (Figure 1). The mucous net then moves posteriorly toward their oesophagus, carrying food particles to their stomach (Sutherland et al., 2010). This feeding mechanism is not modulated in response to particle types, sizes and densities, and is therefore unlikely to allow the salp to distinguish between microplastics and phytoplankton (Harbison et al., 1986).

Secondly, the feeding apparatus of salp is susceptible to clogging resulting from the ingestion of oversized prey or the presence of high particle concentrations (Vargas & Madin, 2004). Salp are unable to remove unwanted materials from their feeding apparatus and therefore the clogging of it often results in the death of the animal (Harbison & McAlister, 1979). It has been reported that small-sized salp were unable to efficiently ingest large prey, such as large diatoms and ciliates (Vargas & Madin, 2004). It has also been reported that phytoplankton blooms (which result in a high particle concentration in the ocean) are often associated with salp population collapse, possibly due to the clogging of their filtering apparatus (Pakhomov & Pakhomov, 1998). Consequently, the presence of pelagic microplastics (especially at a high concentration) may have devastating impacts on salp populations.
Figure 1. The feeding mechanism of salp. The arrow indicates the direction of water passing through their body.

Figure 2. SSV Robert C. Seamans.
This study was conducted as part of the Sea Education Association (USA) S-238 cruise on board the **SSV Robert C. Seamans** from Hawaii to Tahiti between 15 November and 23 December 2011 (Figure 2). While this study examined on the impact of microplastic salp feeding, 20 other studies were conducted simultaneously on board with different focuses (e.g. ocean circulation, ocean nutrient content, etc.) to achieve a broader understanding of the ocean’s role in the global carbon cycle and climate change.

### 3. Materials and methods

#### 3.1 Salp collections

Twelve live salp were collected at six stations during a cruise from Hawaii to Tahiti (Figure 3). Salp were collected using neuston and meter nets (333μm mesh size) deployed at night. The neuston nets were towed at the sea surface for about 30 minutes and the meter nets were towed at a depth of 300 m for about 20 minutes. In order to obtain healthy, normal behaving salp for the feeding experiments, salp species with a robust body were targeted for collection. In the first and second week of the cruise, the health status of different salp species collected were compared and three species were identified to be most suitable for the feeding experiment. These included *Thalia longicauda, Ritteriella amboinensis* and *Cyclosalpa affinis*. All salp used in the study were solo stage salp of the above three species and their size ranged from 1.4 cm to 5.1 cm.

![Figure 3. Study area in the tropical Pacific showing the locations of the sampling areas.](image-url)
3.2 Feeding experiments

Fluorescent polyethylene plastic microspheres (manufactured by Cospheric LLC) were used in this study to simulate the presence of suspended microplastics. These microspheres ranged from 90-106 µm in size and were 98.27 µm on average of 100 microspheres. A stock solution made of fluorescent microspheres and sea water was created in advance with a concentration of 200 microspheres/ml. Each salp was carefully separated from other tow net contents and transferred into a 950 ml feeding jar. This jar was then placed into a larger-sized aquarium to help to minimize the extent of free surface effect on the animals. A selected amount of stock solution (10, 15 or 20 ml) was then added to the jar, giving a low, medium or high microsphere concentration (i.e. 2.1, 3.2 or 4.2 microspheres/ml respectively). Different microsphere concentrations were used in this study to investigate how particle density may affect salp feeding.

Salp were allowed to feed for 1 hour and 15 minutes before they were removed from the jar to estimate the amount of microsphere ingested. The gut, stomach and oral opening of each salp were carefully examined under a dissection microscope (x 30 magnification) and the amount of microspheres ingested was manually counted and digitally recorded. Ingestion of microspheres was defined as the presence of microspheres in a salp’s gut or stomach. The presence of microsphere in its oral opening was not defined as ingestion, rather, it was counted as a separate category. A total of six feeding experiments were conducted on 12 live salp.

4. Results

Ingestion of fluorescent microspheres occurred only in larger-sized salp (i.e. ≥ 3 cm) that were subjected to a high microsphere concentration (i.e. 4.2 microspheres/ml) (Figure 4.1). These include Salp 7 (3 cm), Salp 11 (4.2 cm) and Salp 12 (3.5 cm) (Figure 5.1 and 5.2). Salp 7, in particular, had packaged a large amount of microspheres into its fecal pellets. No microsphere ingestion was found in larger-sized salp that were subjected to a low microsphere concentration (i.e. 2.1 microspheres/ml) (Figure 4.1). On the other hand, ingestion of microspheres was not found in any smaller-sized salp (i.e. < 3 cm) at all microsphere concentrations (Figure 4.1 and Figure 6). Clusters of microspheres, instead, were observed in the oral openings of all smaller-sized salp (except Salp 10, see remark # on Table 1) (Figure 4.2 and Figure 7). Clusters of microspheres were also observed in the oral openings of some larger-sized salp, although this happened at a much lower frequency than for smaller-sized salp. The results of the feeding experiments are summarized in Table 1 and Figure 4.1 and 4.2.
Table 1. Results of the feeding experiment conducted on 12 live salp in the tropical Pacific Ocean.

<table>
<thead>
<tr>
<th>Sampling location</th>
<th>Salp number</th>
<th>Species</th>
<th>Salp size/length (cm)</th>
<th>Volume of stock solution added (ml)</th>
<th>Fluorescent microsphere concentration (microspheres/ml)</th>
<th>Number of microspheres observed in:</th>
<th>Stomach and gut</th>
<th>Oral opening</th>
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<tr>
<td>4°35.8’N 156°37.6’W</td>
<td>1</td>
<td><em>Thalia longicauda</em></td>
<td>4.1</td>
<td>10</td>
<td>2.1</td>
<td>0</td>
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</tr>
<tr>
<td>5°22.9’S 157°20.5’W</td>
<td>2</td>
<td><em>Cyclosalpa affinis</em></td>
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<td>10</td>
<td>2.1</td>
<td>0</td>
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<tr>
<td>6°23.4’S 157°18.9’W</td>
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<td><em>Cyclosalpa affinis</em></td>
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<td>3.2</td>
<td>0</td>
<td>3</td>
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<td>6°23.4’S 157°18.9’W</td>
<td>4</td>
<td><em>Cyclosalpa affinis</em></td>
<td>1.7</td>
<td>15</td>
<td>3.2</td>
<td>0</td>
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<tr>
<td>6°23.4’S 157°18.9’W</td>
<td>5</td>
<td><em>Cyclosalpa affinis</em></td>
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<td>15</td>
<td>3.2</td>
<td>0</td>
<td>136</td>
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<tr>
<td>14°18.7’S 152°32.2’W</td>
<td>6</td>
<td><em>Ritteriella amboinensis</em></td>
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<td>20</td>
<td>4.2</td>
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<tr>
<td>14°28.1’S 152°24.2’W</td>
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<td><em>Thalia longicauda</em></td>
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<td>4.2</td>
<td>463</td>
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<tr>
<td>14°28.1’S 152°24.2’W</td>
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<td><em>Cyclosalpa affinis</em></td>
<td>2.1</td>
<td>20</td>
<td>4.2</td>
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<td>9</td>
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</tr>
<tr>
<td>14°28.1’S 152°24.2’W</td>
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<td><em>Thalia longicauda</em></td>
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<tr>
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Remark #: Air bubbles were accidentally introduced into the body of Salp 10 during the transfer. This salp was unable to swim and feed freely due to the buoyancy of the air bubbles. The result of Salp 10 therefore may not be reliable.
Figure 4.1. Relations between salp size, microsphere concentration and microsphere ingestion.

Figure 4.2. Relations between salp size, microsphere concentration and cluster of microspheres in the oral opening.
Figures 5.1 and 5.2. Ingestion of fluorescent microspheres by Salp 7 (3 cm, top) and Salp 11 (4.3 cm, bottom). Note the presence of fluorescent microspheres in their stomach and the package of microspheres in the fecal pellet of Salp 7.
Figure 6. Absence of microspheres ingestion in smaller-sized Salp 8 (2.1 cm). Note the absence of fluorescent microspheres in its gut or stomach.

Figure 7. Clusters of fluorescent microspheres in the oral opening of smaller-sized Salp 6 (2 cm). The white arrows indicate the direction of water passing through the oral opening.
5. Discussion

5.1 Salp size, microsphere size, microsphere concentration and ingestion

The results of the study suggest a size-specific response of salps to the presence of fluorescent microspheres. Ingestion of microspheres occurred exclusively in larger-sized salps (i.e. ≥ 3 cm) that were subjected to a high microsphere concentration. Although no ingestion of microspheres occurred in the smaller-sized salps (i.e. < 3 cm), clusters of microspheres were found in their oral openings at all given microsphere concentrations (i.e. medium to high).

It is possible that ingestion would only occur when the size of the microsphere is similar to that of the salp’s normal prey. Normal prey of salps that were 0.4-1.37 cm in body size has been reported to be between 5-62 µm (Vargas & Madin, 2004). Given the average microsphere size used in this study was 98.27 µm, these microspheres were likely to be closer to the size of normal prey of the larger-sized salp than the smaller-sized salp of the study. The clusters of microspheres observed in the oral openings of all the smaller-sized salps were likely to be a sign of clogging of their feeding apparatus due to exposure to microspheres larger than their normal prey. This observation is consistent with previous studies that reported small salps are unable to efficiently ingest large diatoms and ciliates, and these large prey can potentially clog up a small salp’s feeding apparatus (Vargas & Madin, 2004).

5.2 Possible negative impact of microplastics on salp

Based on the size-specific response of salps to the microspheres showed in this study, microplastics are likely to negatively affect salps of different sizes in different ways. For larger-sized salps, ingestion of microplastics is likely to occur at a high microplastic density. Salps that are ~ 3-4.3 cm (i.e. the size of the larger-sized salps in this study) are expected to ingest microplastics of up to 90-106 µm in size (i.e. the size of the microspheres). The exact biological and physiological consequence of microplastic ingestion to filter-feeders is unknown. However, a reduction of nutrient gain and increase in body toxicity level can be expected. These negative impacts may lead to poor health and fecundity of salps, affecting their role in the carbon cycle. Furthermore, ingested microplastics are likely to be packaged into a salp’s fecal pellet and subsequently sink into the deep ocean. This is supported by the package of microspheres into the fecal pellet of Salp 7. It is uncertain how the ocean and marine biota will be affected by this new phenomenon of downward microplastic flux, however, the introduction of microplastics to the benthic communities is likely to be negative.
On the other hand, ingestion of microplastics is unlikely to occur in smaller-sized salp regardless of the microplastic concentrations. Based on the clusters of microspheres observed in the oral openings of the smaller-sized salp in this study, the major threat of microplastics to small salp is likely to be clogging of their feeding apparatus. Small salp that are ~1.4-2.7 cm (i.e. the size of the smaller-sized salp in the study) are unlikely to ingest microplastics that are greater than 90-106 µm at any microplastic concentration. Since salp are unable to remove unwanted materials from their feeding apparatus (Harbison & McAlister, 1979), its clogging is therefore likely to be detrimental to their survival, as well as to their capacity of continuous downward carbon flux in the carbon cycle.

The extent to which microplastics can negatively affect salp feeding depends on the microplastic concentration in the ocean. This concentration, however, is not constant throughout the ocean. In general, microplastic concentration inside a gyre is higher than that outside a gyre. For instance, a low microplastic concentration of 650 pieces/km² (pieces of plastic per square kilometer) was reported during the same cruise from Hawaii to Tahiti (Phalen & Citron, 2011), yet a high microplastic concentration of 334,271 pieces/km² was reported in the North Pacific Subtropical Gyre (Howell et al., 2012). When comparing the above microplastic concentrations with that used in this study (i.e. 2.1-4.2 microspheres/ml), the current microplastic concentrations are relatively low and should have a limited negative impact on salp feeding. However, macroplastics will disintegrate over time and the number of microplastics is expected to multiply in the future. For this reason, the negative impact of microplastics on filter-feeders like salp is likely to intensify in the future and the problem must not be ignored.

5.3 Limitations

One potential bias in this study was the health conditions of salp in the feeding experiments. The majority of the larger-sized salp was in a better condition than smaller-sized salp and the former remained healthy throughout the feeding experiment. Some smaller-sized salp were less healthy and may have swum and fed less actively than their larger-sized counterparts. Nonetheless, since healthy and less healthy salp were present in both the larger-sized and smaller-sized salp category, the potential bias that was introduced due to differential health conditions is likely to be limited.

6. Conclusion and recommendations

In summary, the type of the negative impact of marine microplastics on filter-feeders like salp is expected to be size-dependent. While microplastic...
ingestion is likely to occur in larger-sized salp subjected to a high microplastic concentration, clogging of feeding apparatus is likely to occur in small-sized salp at medium to high microplastic concentrations. In both cases, the presence of pelagic microplastics is likely to have negative effects on their survival, feeding efficiency, fecundity, and their role in the carbon cycle. More studies are needed to examine the biological and physiological consequences of microplastics ingestion by filter-feeders like salp, as well as how these negative impacts may be magnified further up the food chain. Future studies are recommended using only healthy, active swimming salp for similar feeding experiments. Instead of a net tow, healthy, undamaged salp can be obtained by a SCUBA diver using a hand-held jar. In this way, a wider range of salp including less robust salp species and fragile smaller-sized salp can also be included in the study.

Acknowledgements

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References


Giving the Nod to Bacterial Symbionts: The Nod Signal Transduction Pathway

Kevin Murray

Abstract

This in-depth review summarises recent advances in the elucidation of the Nod factor-induced signal transduction pathway. It discusses the discovery and characterisation of three proteins, DMI3, CIP73 and IPD3. DMI3 is a CCaMK-like kinase which acts as a master switch for both rhizobial and mycorrhizal symbioses. IPD3 is a downstream phosphorylation target of DMI3, specific to the nodulation pathway. Its function is not fully elucidated, however is required for correct infection thread formation, and development of functional nodules. CIP73 is also a downstream target of DMI3, however its function is not known. Cip73 mutants show impaired nodule development, and reduced rhizobial infection, indicating that CIP73 is required for nodule organogenesis. The discovery of these three proteins represents a significant advance in the elucidation of the molecular mechanisms of rhizobial nodulation, and furthers the goal of harnessing this sustainable source of fixed nitrogen for agricultural purposes.

Introduction

Legumes have long been known to enter into symbiotic associations with specific rhizobial bacteria, for the purpose of obtaining symbiont-generated nitrogen sources. The interaction between the symbiont and host is highly specific, and involves a complex bidirectional signalling pathway (Lerouge et al. 1990). Flavonoids and isoflavonoids are released by the roots of legumes, which are detected by specific rhizobia. In reply, these release lipochitooligosaccharide molecules termed Nod factors. These Nod factors are perceived by legumes using both nodulation-specific (Nod) and the pathway common to both mycorrhization and nodulation, general symbiosis (Sym), signal transduction pathways, effecting the morphological, biochemical and transcriptomic changes required to allow symbiosis (Ané et al. 2002; Catoira et al. 2000; Lerouge et al. 1990). The upstream elements of these pathways is shown graphically in Figure 1.
The precise elucidation of these signal transduction pathways is crucial to understanding the mechanisms of nodulation, and to any possible future application of this knowledge to crop science and biotechnology. This essay will summarise a number of important studies which have identified elements of these pathways.

Figure 1: Upstream components of the sym and nod pathways.

The pathways described here are still putative. While the relative ordering of regulatory elements has been at least partially elucidated, no full signalling pathway has been published.

The DMI3 $\text{Ca}^{2+}$ and Camodulin-dependent protein Kinase

A study by Gleason et. al. (2006) investigated the structure and function of *M. truncatula* DMI3, key regulator of the Nod and Sym signal transduction pathways. The DMI3 protein is a $\text{Ca}^{2+}$/Camodulin-dependent protein Kinase (CCaMK), which is activated by $\text{Ca}^{2+}$ and/or camodulin (CaM) binding and phosphorylates specific substrates including itself, signalling the reception of Nod factors to downstream regulatory proteins (Lévy et al. 2004). DMI3 is
a 523aa protein, which consists of (from N- to C-terminus) a serine/threonine protein kinase, overlapping CaM binding and autophosphorylation domains and three EF hand Ca\(^{2+}\) binding domains.

Gleason and colleagues created a series of mutants which lacked various domains of the DMI3 protein, and point mutations which altered the autophosphorylation site. Deletion mutants lacking the autoinhibition domain cannot bind CaM, and constitutively phosphorylate substrates and were termed autoactivated. Autoactivated mutants could not complement \textit{dmi3} mutants to allow establishment of symbionts. Point mutations in the autophosphorylation site showed similar phenotypes to autoactivated mutants, however these point mutations complemented \textit{dmi3} mutants, and allowed establishment of symbionts.

Gleason and colleagues also investigated the ability of autoactivated mutants of DMI3 to complement other Nod and Sym pathway mutants. Autoactivated DMI3 does not complement GRAS transcription factor mutants \textit{nsp2-1} and \textit{nsp1-2}, indicating that NSP2 and NSP1 probably function downstream of DMI3, and supporting previous studies (Catoira et al. 2000; Kalo 2005; Smit et al. 2005). These authors also observed that autoactivated mutants of DMI3 can complement loss of function mutants in the putative receptor-like kinase DMI2 and the putative cation channel DMI1, indicating that these proteins must function upstream of the DMI3 protein, as suggested by previous results (Catoira et al. 2000; Endre et al. 2002; Ané et al. 2004). Additionally, these authors have shown that expression of Nod factor-induced (NOD) genes becomes constitutive in autoactivated mutants. Expression of a Nod factor-induced GUS expression construct was used to evaluate NOD gene expression; mutants that showed constitutive substrate phosphorylation also showed constitutive GUS expression. This result lends further evidence to the propositions that DMI3 is the master regulator of the nodulation signalling pathway.

Gleason et al. (2006) illustrate the role of each domain in the function of DMI3, and shed light on the regulatory mechanism of this crucial step in the Nod and Sym signal transduction pathways. In wild type \textit{M. truncatula}, Ca\(^{2+}\)-induced autophosphorylation is thought to allow binding of CaM to the CaM binding domain, alleviating autoinhibition and allowing substrate phosphorylation. Gleason et al. (2006) demonstrate that removal of the autoinhibition domain causes spontaneous nodule formation in the absence of rhizobia, indicating that this domain negatively regulates DMI3 activity and nodule formation. Gleason et al. (2006) interpret their results in the context of the partially elucidated Nod and Sym signal transduction pathways. These authors propose that DMI3 functions downstream of the DMI1 and DMI2 proteins, and regulates expression of NOD genes, indicating it is an upstream regulator of these genes and ultimately
of nodulation. This functional characterisation of the DMI3 upstream regulator allowed subsequent studies to elucidate the existence and function of elements downstream of DMI3.

Recent advances in elucidation of the Sym and Nod signal transduction pathways

Identification of the interacting protein of DMI3 (IPD3) protein

A study by Messinese et al. (2007) has identified a novel protein which interacts with DMI3 in M. truncatula. Using a yeast two-hybrid (Y2H) system, these authors identified a novel protein, which interacts with DMI3 in vitro and in planta. The IPD3 protein is reported by these authors as functionally redundant for the formation of rhizobial nodules.

Messinese et al. (2007) used a Y2H system to identify the IPD3 protein from a cDNA library from M. truncatula roots. A full coding sequence of the gene was obtained, and putative domains were identified. The IPD3 protein was identified as a coiled-coil containing protein, and was mapped to a BAC corresponding to the short arm of M. truncatula chromosome 5. Putative orthologs were identified in several monocots and dicots, including L. japonicus but not in Arabidopsis, indicating it is a conserved locus.

A quantitative PCR (qPCR) experiment showed preferential expression of IPD3 and DMI3 to root tissue, and split YFP bimolecular fluorescence complementation studies showed co-localisation of DMI3 and IPD3 to the nuclei of these cells. These results confirm those previously obtained for DMI3 (Gleason et al. 2006). A subsequent mutagenic study of L. japonicus by Yano et al. (2008) identified the CYCLOPS protein, an ortholog of IPD3. These authors show that CYCLOPS is highly structurally and sequentially similar to IPD3, and that it is expressed and localised in the nucleus, similarly to DMI3 and IPD3.

RNAi knock-down caused significant reductions in the qPCR abundance of IPD3 transcripts in transgenic plants, however did not cause any significant change in nodule morphogenesis or rhizobial infection phenotypes. Messinese et al. (2007) suggest that this indicates that either the IPD3 protein is specific to the arbuscule formation pathway (which was not investigated), or that the IPD3 protein is functionally redundant, despite finding no candidate homologs, as nodulation still occurs at low IPD3 transcript levels. These statements appears to have been disproven by a subsequent study by Horváth et al. (2011), discussed
Giving the Nod to Bacterial Symbionts: The Nod Signal Transduction Pathway

in detail below. Additionally, CYCLOPS mutants had phenotypes deficient in formation of functional arbuscules and nodules, but not nodule organogenesis itself (Yano et al. 2008).

Messinese et al. (2007) identify and partially characterise a novel protein that interacts in vivo with the DMI3 protein of *M. truncatula*. This investigation has made important headway in elucidating the signal transduction pathway downstream of CCaMK/DMI3 in *M. truncatula*. However, this paper does not fully characterise the IPD3 protein, nor does this investigation record comprehensive phenotypes of IPD3 mutants, although this is listed as a future priority of the authors.

Further characterisation of the interacting protein of DMI3 (IPD3) protein

A recent investigation by Horváth et al. (2011) characterises the IPD3 protein identified by Messinese et al. (2007) in a more rigorous manner. These authors identified *IPD3* from a transposon-tagged insertion mutagenised *M. truncatula* population, and characterise this mutant, thus inferring the function of IPD3. They find that the primary function of IPD3 is in correct infection thread (IT) formation, and confirm previous mapping, localisation and structural studies and the action of IPD3 as a downstream phosphorylation target of DMI3 (Messinese et al. 2007).

Horváth et al. (2011) report novel results regarding the *in planta* function of IPD3. Two IPD3 mutants, *ipd3*-1 and *ipd3*-2, showed IT formation defective to various degrees; nodules which formed in the presence of rhizobia did not contain bacteroids, and showed no nitrogenase activity. Differences in cellular structure of ITs were also observed. These mutants were complemented with *IPD3*, both using native and constitutive promoters. Constitutive *IPD3* expression did not complement *ipd3* mutants, forming non-functional nodules. Native *IPD3* expression fully complemented both *ipd3* mutants. *Ipd3* mutants were also fully complemented with the *L. japonicas* CYCLOPS ortholog under its native promoter (Yano et al. 2008). The phenotype of IPD3 mutants with regard to arbuscule formation was also investigated, showing that these mutants were defective in the formation of arbuscules. These results also indicate that native temporal specificity in the expression of IPD3 is required for correct function

*Ipd3* mutants did not show Nod factor-inducible expression of NOD genes, indicating that IPD3 is upstream of such genes. A Ca$^{2+}$ spiking signal identical to that of wild type plants indicates that the *IPD3* mutant is downstream of this signal. In the context of previous work on IPD3 (Messinese et al. 2007), this
places the IPD3 protein between DMI3 and the expression of Nod factor-induced
genes. The observation that both arbuscule and nodule formation are affected
by *ipd3* mutants places IPD3 in the Sym pathway common to both symbioses.

Horváth et al. (2011) communicate a study which characterises the IPD3 protein.
These authors find that IPD3 is a regulatory element downstream of DMI3, but
upstream of NOD genes. IPD3 is observed to be crucial to the correct formation
of ITS and arbuscules, placing it in the Sym pathway common to both rhizobial
and mycorrhizal symbioses.

The CIP73 protein, a novel CCaMK phosphorylation
target

Kang et al. (2011) present a study that identified and characterised a novel
protein, which acts as a phosphorylation target for the CCaMK protein of *Lotus
japonicus*. These authors identified a protein that interacted with DMI3 in Y2H
studies, and conducted several further analyses. They determined that CIP73
acts downstream of the DMI3 protein and is part of the Nod pathway.

These authors conducted a Y2H experiment to determine protein-protein
interactions of the serine/threonine protein kinase domain and proteins encoded
by an *L. japonicus* root cDNA library, as a screen for proteins which interact with
the kinase domain of CCaMK. Further protein-protein interaction studies showed
that *in vivo* and *in planta* full length CIP73 interacts with full length CCaMK.
The full cDNA sequence was obtained and bioinformatic studies revealed that
the protein contained an N-terminal domain with similarity to *Xenopus* Scythe
ubiquitin, and a C-terminal nuclear localisation signal. Orthologous genes
were discovered in several plant genomes, including *A. thaliana* and *M. truncatula*.

Kang and colleagues also investigated the expression and localisation of CIP73.
Using qualitative RT-PCR, CIP73 was found to be expressed at higher levels
in roots compared to all other tissues. CIP73-GFP gene fusions were found to
be localised to the nucleus of epidermal cells of *L. japonicus*. *In vivo* studies
used to characterise the interaction between CIP73 and CCaMK found that the
N-terminus of CIP73 is phosphorylated by CCaMK in yeast. Autophosphorylation
of CCaMK was increased by addition of Ca\(^{2+}\), however phosphorylation of CIP73
was only increased in the presence of CaM, a phosphorylation pattern which
matches that of CYCLOPS (Yano et al. 2008).

Using RNAi, Kang and colleagues show that the CIP73 protein is required for
correct *Rhizobium*-induced nodule formation, but is not required for arbuscule
formation. On inoculation of CIP73 RNAi knockdown roots with *Mesorhizobium
loti*, significantly fewer nodules formed, and observation of nodules stained for
β-galactosidase activity showed that significantly fewer rhizobia reached nodule
cells. Kang and colleagues interpret this observation to indicate the CIP73 protein controls nodule organogenesis, not rhizobial infection. A similar investigation of arbuscule formation after inoculation of CIP73 RNAi transformants with the mycorrhizal fungus *Glomus intraradices* found typical arbuscule formation, indicating that CIP73 is specific to the Nod signal transduction pathway.

Kang and colleagues present a comprehensive study, which identifies and characterises a novel protein that is a phosphorylation target for CCaMK in *L. japonicus*. CIP73 showed expression, localisation and *DMI3* interaction characteristics similar to those described in other CCaMK phosphorylation targets (Horváth et al. 2011; Messinese et al. 2007). The CIP73 protein was determined to act downstream of the *DMI3* protein. RNAi mutants demonstrate that CIP73 is required for *Rhizobium*-induced nodule formation, but is not required for arbuscule formation, and therefore is part of the Nod pathway. However, these authors do not propose any mechanism of action for this novel protein.

**Conclusion**

This essay has discussed three recent investigations that elucidate and characterise two novel regulatory proteins downstream of the master regulator of the Sym and Nod pathways. IPD3 and its orthologs are regulators crucial to the establishment of symbioses with rhizobia and arbuscular mycorrhizae, but not to organogenesis. The CIP73 protein is required for correct nodule formation, but not for arbuscule formation. While these results were obtained in *M. truncatula* and *L. japonicus*, previously observed similarity between *L. japonicus*, *M. truncatula* and other legumes in several elements of Sym and Nod pathway (Horváth et al. 2011; Sieberer et al. 2009; Yano et al. 2008) suggests that these results may be generalised to most legumes.

Through these and other similar studies we have the beginnings of an outline of regulatory networks involved in nodule formation and rhizobial symbiosis. However, we are far from fully elucidating the full Nod and Sym pathways; nor have we fully characterised the molecular function of discovered elements of these pathways. Given the high cost of nitrogenous fertilisers in a world facing increasing energy costs and food demand, there is keen interest in the application of these discoveries to non-legumes, aiming to impart the symbiont-generated nitrogen sources to these crops. To be able to put knowledge of rhizobial symbiosis obtained thus far to practical use in these areas, a clearer understanding of the regulation of nodulation is required. Work on elucidation of these pathways is ongoing, and represents an important line of future investigation in plant and crop science.


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Aman Gaur

The separation of the judicial function from the other functions of government advances two constitutional objectives: the guarantee of liberty and, to that end, the independence of Ch III judges.

Brennan CJ, Dawson, Toohey, McHugh, Gummow JJ articulating ‘the Wilson proposition’ in Wilson v Minister for Aboriginal and Torres Strait Island Affairs

Abstract

The nature of the Australian Constitution means that it provides only for a separation of powers between the legislature and executive working as one in the Westminster Parliament and the unelected judiciary. This paper considers whether this doctrine of separation of (judicial) powers achieves, as argued by the High Court, the ‘constitutional objectives’ of an independent judiciary and, in consequence, ‘the guarantee of liberty’. After analysing the nuances of political terms such as "liberty" and the dynamic rationales of Australian federalism, this paper submits that the doctrine does advance a practical degree of judicial independence which facilitates a species of individual liberty under the Constitution. However the paper concludes by critiquing recent High Court decisions that have increasingly curtailed this ‘liberty’ through narrow judicial methodology, weakened notions of ‘judicial power’ and overt deference to parliament.

1 (1996) 189 CLR 1, 11 (‘Wilson’).
Introduction

This paper submits that the separation of judicial power principles advance a practical degree of judicial independence which facilitates a limited but increasingly curtailed ‘guarantee’ of republican ‘liberty’ for individuals under the Australian Constitution.  

Section I will articulate the Constitution’s ‘liberty’ to clarify and focus the analysis. Section II will demonstrate positivist-textual constitutionalism buttressed by political philosophy and historical practice as the bases of the Wilson proposition. Section III will detail the prevailing institutional, legal and socio-political factors that limit judicial independence and the scope of republican liberalism for individuals, despite the principled judicial separation doctrine.

I – Ideology and Wilson

Ideological ambiguity

Being a political ideology, ‘liberty’ is inevitably ambiguous and amorphous. Conceptions of ‘liberty’ vary in their appreciation and justification of public power, while still maintaining consistency with the separation of powers doctrine. ‘Liberty’ can also be achieved in varied means: federated states pursue institutional ‘liberty’ through jurisdictional allocations of public power; functional ‘liberty’ can prosper in the individual endowment of rights/freedoms.

This paper considers the Wilson proposition in the context of institutional ‘liberty’ and specifically its understanding in the form of three alternatives. The first, ‘negative liberalism’, aims to minimise the state’s interference with individual liberty by impeding the exercise of government power. A developed model of the first, ‘republican liberalism’, disperses government authority to minimise arbitrary exercises of power. The third vision, ‘efficient liberalism’, assigns the state’s various powers to those most skilled in its exercise.

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2 Waterside Workers’ Federation of Australia v JW Alexander Ltd (1918) 25 CLR 434 (‘Alexander’s Case’); R v Kirby; Ex parte Boilermakers’ Society of Australia (1956) 94 CLR 254 (‘Boilermakers’).
4 Barber, above n 3, 60–61.
6 Barber, above n 4, 65.
In Australian constitutionalism the ‘guarantee’ is most aptly understood as one of republican liberalism, supplemented by efficient liberalism. The Constitution limits exercises of power by diffusing power amongst jurisdictions and separate branches of federal government. It approves federal legislative power pursuant solely to explicit ‘heads of power,’ ‘subject to [the] Constitution’. Judicial review of public power is ‘axiomatic’. The Constitution strives for efficient liberalism also by specialising the judicial function to federal courts.

Notably, judicial separation advances the ‘two constitutional objectives’ by supplementing other institutional mechanisms including, inter alia, responsible government in the House of Representatives, the Senate and Senate Committees.

Wilson’s ‘liberty’

As the illuminating rationale of judicial separation, the ends of republican liberalism have changed paradigms since 1901. At Federation, the Constitution brought together six colonies by placing heavy emphasis on the security of each jurisdiction’s ‘liberty’. Following WWII, international and domestic efforts to protect individual ‘liberty’ coalesced around the human rights movement. Municipal antipodean jurisprudence conceived of this movement as the confinement of an individual’s liberty solely by law before an independent judiciary. Where it had previously protected institutional federalism, republican liberalism now operated functionally to protect the people of those States. As similar international jurisdictions enacted forms of entrenched human rights, the Chapter III implied rights jurisprudence portended to similar effect in the mid-1990s. The Wilson proposition in its reference to ‘liberty’ is thus correctly contextualised as emphasising the attainment of individual freedoms through republican liberalism.
II – Legalism and philosophy

Positivist-textual constitutionalism

The ‘mutated’ Australian separation of powers flows from textual and structural implications in a written constitution. The separation of judicial powers doctrine is also elucidated through this method of positivist-textual constitutionalism, or legal constitutionalism. Its two ‘fundamental’ principles quarantine Commonwealth ‘judicial power’ to s71 courts and exclusively confine exercises of judicial power to them, alongside non-exclusive incidental non-judicial power.

Chapter III courts are exclusively charged with the responsibility of determining the parties’ pre-existing (statutory, common law or constitutional) rights and liabilities and exercising judicial review. Republican liberalism is achieved through this positivist-textual reasoning by limiting the exercise of public power based on the legal scrutiny by an independent judiciary. This analysis has been repeatedly upheld despite weaknesses in the textual support for judicial review and succinct criticism of these conclusions as being grounded in merely a “draftsman’s neat arrangement”.

Incongruence of ideas

Judicial independence is the ‘bulwark of the Constitution’ but the judicial separation doctrine does not necessarily behove its existence. The former aims for the impartial administration of justice; the latter insulates judicial function from


Constitution of Australia Constitution Act, Chapter I is headed ‘The Parliament’ and vests legislative power of the Commonwealth in a ‘Federal Parliament’ (s. 1). Chapter II is headed ‘The Executive Government’ and vests the ‘executive power of the Commonwealth’ in ‘the Queen’, ‘exercisable by the Governor General as the Queen’s representative’ (s. 61). Chapter III is headed ‘The Judicature’ and vests the judicial power of the Commonwealth in a ‘Federal Supreme Court’ (s71); see United States Constitution art I, s1; art II, s1, 3; art III.

Adam Tomkins, above n 3, 10.


Alexander’s Case (1918) 25 CLR 434; Boilermakers (1956) 94 CLR 254.

See Huddart, Parker and Co. Proprietary Ltd v Moorehead (1909) 8 CLR 330, 347 (Griffith CJ); Wheeler, above n 4, 174.


other government branches. The High Court has rationalised this incongruence by emphasising that the separation of powers concerns both the allocation and exercise of government functions which, in Chapter III, implies that judicial power be exercised independently and impartially. Therefore, while the two ideas are not ‘coterminal’, their constitutional intersection allows judicial independence to illuminate the objects and purpose of the separation doctrine.

Multiple political philosophies

This illustration belies the logical weaknesses in the flow of abstract ideas and the Court’s reliance on normative political ideology to smooth such disruptions. Consistent implementation of these ideologies, however, presents further challenges; for example, the separation of powers is itself vitiated by delegated legislation in a Westminster Parliament. Recognising responsible government in the British-Australian parliamentary tradition and re-doubling focus on judicial separation has upheld this normative inconsistency. Holistically, this circularity of logic demonstrates that: i) positivist-textual constitutionalism, normative political philosophies and historical tradition have variously informed justifications of the judicial separation principles; and ii) the judicial separation doctrine exhibits significant variation in theoretical approaches, including, inter alia, federalism and checks and balances. As illustrated above however, many species of ideology can be achieved through republican liberalism. The restraining of public power by an independent judiciary can achieve the terms of the federal compact, guard against the executive ‘over-balancing’ the legislature and, as demonstrated below, also protect individual freedoms. The ability of republican liberalism to achieve this bewildering array of constitutive ambitions consolidates its aptness as the correct conception of ‘liberty’ in Australian constitutionalism.

Grounding ‘liberty’

The philosophical fathers of the various Anglo-sphere constitutions emphasised the need to guarantee individual liberty, but with crucially different foci. The Federalist Papers’ authors focussed on human fallibility, which necessitated the political solution of dispersing power in a limited constitution to create checks

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27 Wheeler, above n 4, 105.
29 Wilson (1996) CLR 1, 10 (Brennan CJ, Dawson, Toohey, McHugh and Gummow JJ): commenting on checks and balances as the key rationale; see also Alexander’s Case (1918) 25 CLR 434 (Rich, Isaacs JJ) noting states’ security and prevention of Commonwealth interference.
and balances that were regulated by an independent judiciary functioning in a strict separation of powers.\textsuperscript{30} In contrast, Blackstone conceived of a subject’s ‘life, liberty and property’ being protected by an independent judiciary extolling of the common law in an unwritten British constitution.\textsuperscript{31} Delegates to the conferences debating the Australian ‘Washminster’\textsuperscript{32} Constitution did not appreciate these nuances of political philosophy,\textsuperscript{33} being instead focussed simply on the ends achieved by an independent and impartial judiciary.\textsuperscript{34}

The Constitution’s amalgamated founding and opaque philosophy thus empowered the High Court with the responsibility of articulating this document’s functional operation.\textsuperscript{35} Its elucidation has struggled to win persuasive appeal, however, due to a reticence in choosing and communicating the philosophical choices that buttress the primary positivist-textual constitutional methodology.\textsuperscript{36} This paper submits that despite this ambiguity, the political philosophy of the \textit{Federalist}, rather than Blackstone, is more consistently and convincingly reflected in High Court jurisprudence. The Australian separation of powers limits public power in a written, federated constitution and emboldens the judicature with judicial review. Despite a pragmatic focus on judicial separation in light of its Westminster heritage, the Court has shied away from Blackstonian conceptions of ‘judicial power’ to enliven the common law. It is this constitutional paradigm that informs the scope for protection of individual freedoms through republican liberalism in Australia, which is analysed below.

\section*{III – ‘Guarantees’ and compromises}

A limited attainment of individual freedoms through republican liberalism, facilitated by judicial independence, is possible. The \textit{scope}, however, for republican liberalism to achieve this outcome is increasingly curtailed in Australian constitutionalism, alongside a lowered standard of independence.

\begin{thebibliography}{99}
\bibitem{30} Patapan, above n 14, 393.
\bibitem{31} Ibid, 394.
\bibitem{33} Patapan, above n 14, 397.
\bibitem{34} See above: ‘Wilson’s ‘liberty’.
\bibitem{35} Patapan, above n 14, 397.
\bibitem{36} Wheeler, above n 22, 104.
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Delivering the ‘guarantee’

As demonstrated above, public power can only be exercised subject to the Constitution’s diffusions of power. The specialised and independent constitutional interpreter advances republican liberalism by ensuring individuals’ freedom from unlawful federal and State legislative power within the federal diffusion of power.

The conceptions of triadic government power also hold relevance for individual freedoms. Legislative Bills of Attainder and orders against release from detention are invalid as usurpations of judicial power. ‘Judicial power’ jurisprudence endows individuals with rights of procedural due process. As beneficiaries of a developing conception of ‘judicial standard,’ citizens can only be subject to Commonwealth ‘judicial power’ by s71 courts immune from political interference and governed by judicial process.

Positivist-textual constitutionalism has also privileged Australian citizenship and implied political communication freedoms. The strict interpretative methodology also regulates exercises of public power through numerous other provisions: s80; s116; s117 and s75(v). With appeals from State courts to the High Court, these liberties are nationalised through one Australian ‘common law.’

Therefore the Federalist desire for courts to act as ‘bulwarks of a limited Constitution against legislative encroachment’ is meaningfully achieved in the individual paradigm. Although Tomkins persuasively notes British
Parliamentary means to these outcomes, the Australian Constitution intends and so endows the courts with tools to better perform this function than their English counterparts.50

‘Guarantee’ compromised

While a society governed according to law is a firm guarantee of individual security,51 these constitutional protections are patchy and arbitrary.52 The limited scope of individualised constitutional freedoms is explained by the intertwined effects of a philosophical reliance on parliamentary sovereignty to protect individual rights,53 ideologically vitiating legislative rights entrenchment,54 and the High Court’s conservative jurisprudence. The Court has hollowed-out the scope for individual freedoms in this paradigm through: i) narrow interpretative and conservative judicial methodology; ii) weakened ‘judicial power’ concepts; and iii) deference to Parliament, particularly during the age of ‘securitisation’.

Legal constitutionalism is the Court’s basal interpretative methodology.55 The resulting strict constitutional interpretation56 is divorced of the rich common law history upon which the ‘Washminster’ Constitution rests.57 Common law constitutionalism, which urges interpretative outcomes based on deeper values of constitutionalism, has enriched British jurisprudence but received little notice in Australia. Setting aside such substantive ‘rule of law’ doctrines,58 even the basic common law ‘principle of legality’ has only received sporadic support.59 This demonstrates a conservative rejection of a rich common law and the suffocating influence of narrow positivist-textual legalism in Australian constitutional jurisprudence.

50 Cf. Tomkins, above n 4.
53 E.g. Racial Discrimination Act 1975 (Cth); Sex Discrimination Act 1984 (Cth); Human Rights (Sexual Conduct) Act 1994 (Cth); Disability Discrimination Act 1992 (Cth).
56 See Amalgamated Society of Engineers v Adelaide Steamship Co Ltd (1920) 28 CLR 129.
57 Australian Communist Party v Commonwealth (1951) 83 CLR 1 (Dixon J).
58 Wheeler, above n 4, 108.
Moreover, ‘judicial power’ has been almost holistically rinsed of deeper value. Blackstonian ‘judicial power’ ‘immunities’ that portended a ‘great reservoir of rights’ have been swept away, carrying with them even rights firmly rooted in the curial process and thus more amenable to legal constitutionalism. The remaining vestiges of the Blackstonian jurisprudence are mere ‘procedural rights’. Furthermore, the modern regulatory state has also threatened to engulf the ‘judicial power’ concept by arguably scuppering the conclusive ‘rights creation/determination’ distinction.

The Court’s attitude that Parliamentary will should prevail subject to explicit Constitutional limits has morphed into a dangerous degree of deference that misplaces the substance of constitutional republican liberalism. This is especially so in the present age of ‘securitisation’, a term that describes the political act of successfully enacting extraordinary police measures in the defence of security. The substantive expansion of particular ‘heads of power’ and validation of retrospective deeming and criminal legislation illustrates a misplaced responsibility, even within a framework explained by parliamentary sovereignty.

The abdication has only heightened in the years following the tumultuous events of September 11, 2001, which precipitated two global conflicts in the Middle East and created an increase in maritime asylum-seekers from those conflicts. ‘Securitisation’ was initially upheld in Fardon when the High Court validated state legislation that allowed the continued detention of persons who had completed prison sentences for serious sexual offences if there was an ‘unacceptable risk’ the prisoner might commit a serious sexual offence in the future. It was then gleefully re-legislated as detention orders in Thomas without the requirement of criminal conviction and absent procedural safeguards. Encouraged by this deference, State Parliaments legislated for control orders beyond ‘anti-terror’ purposes which have been substantially upheld. As

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61 Zines, above n 12, 176.
64 R v Quinn (1977) 138 CLR – e.g. trial for determination of criminal guilt, also certain basic procedures of courts for judicial proceedings; Dietrich v The Queen (1992) 177 CLR 292.
65 Huddart, Parker and Co. Proprietary Ltd v Moorehead (1909) 8 CLR 330, 347 (Griffith CJ).
66 Saunders, above n 4.
70 Lane v Morrison (2009) 239 CLR 230; Re Macks; Ex parte Saint (2000) 204 CLR 158.
73 Serious and Organised Crime (Control) Act 2008 (NSW), Crimes (Criminal Organisations Control) Act 2009 (SA); see also Criminal Organisational Act 2009 (Qld).
asylum-seeker numbers from war-torn countries increased, the Court backed away from precedent and continued its deference to Parliamentary purpose. This was acutely reflected in a series of cases in 2004–2005 where the High Court cast doubt on its previous authority. In _Lim_, the High Court had articulated a ‘constitutional immunity’ that prohibited the punitive detention of citizens by the executive. More importantly, the Court identified limits on the non-punitive executive detention of aliens. However, in _Al-Kateb_ and _Re Woolley_ the Court’s validation of indefinite detention and the detention of children (respectively) was based not on the nature of the detention, but on its purpose. Justice Gummow pointed out in a persuasive dissent that the legislation’s stated purpose of exclusion from the Australian community was punitive. His Honour noted that it also potentially breached the hallowed Communist Party Case principle that the Parliament cannot determine the very facts upon which the existence of its exercise of power depends.

The lower-level Federal Court followed this approach when it validated indefinite detention without conviction in the ‘Tampa-litigation.’ This was based on an expansive interpretation of the ‘aliens’ power and despite the Constitution’s republican foundations, broadened the executive power. In uncertain times, parliamentary supremacy and legal constitutionalism have been heartily re-adopted amidst a ‘moral panic’ engulfing the judiciary. Given this abnegation, these instances cumulatively give rise to uneasy questions about the threat to individual freedom from government rather than militants.

**Fractured independence**

Despite widespread dynamism in Australian society and government since Federation, federal judicial independence has remained a reassuring touchstone for the Court, befitting extension to State courts exercising federal judicial power. That the strict judicial separation achieved judicial independence, with assistance from s73, is reflected in the attempts legislatures have made to

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share the cloak of legitimacy. In accommodation of these ungainly attempts, the doctrine has proven an uncompromising bar in the modern regulatory state which has led to its lowering through institutional and functional means.

Highlighting the artificiality of functionally dividing government powers, the doctrine was relaxed for practical purposes with technical ideas such as double-function provisions and the ‘chameleon doctrine’, which allows the nature of the body exercising the power (e.g. court or tribunal) to define its definition as ‘judicial’ or ‘non-judicial’. These Kafkaesque devices question the very existence of the judicial power’s core characteristic in their exercise by courts and threaten to swallow the distinctions between government powers. Further, public confidence in the judiciary was exploited by Parliament through the use of judges in executive functions in their personal capacity. The cloak was shared and justified with an undefined and unclear test of ‘incompatibility’ that beguilingly distinguished between courts and their constituent members. Although limits were duly recognised, the valuable institutional separation had been tampered. Various other situations also demonstrated the flexibility of the judicial separation doctrine, raising questions about whether judicial participation in executive function allowed courts to satisfactorily safeguard individuals against state abuses.

In the age of ‘securitisation’ this fear was realised through court involvement in the authorisation of control/detention orders. Thomas v Mowbray considered court-approved control orders for suspected terrorists. Gleeson CJ’s troubling remarks that the courts were better placed to determine detention than the executive risked the ‘efficiency’ rationale of the separation of powers. The detention order legislation called on courts to consider matters outside their competence (i.e. national security), apply arguably non-judicial standards and created issues of polycentricism, thus compromising, at least, the appearance of independence.

87 Wilson v Minister for Aboriginal & Torres Strait Islander Affairs (1996) 189 CLR 1.
89 Mason, above n 74, 7.
91 Ibid [19].
92 Meyerson, above n 41, 229.
Thankfully, the Court has returned to more principled grounds by invalidating state legislation that removed judicial discretion and disallowed the publication of reasons for control orders, respectively. The impetus behind these developments in the recent line of cases in the *Kable* doctrine has been the subject of academic conjecture. It is briefly submitted that the *Kable* doctrine realises an implied separation of powers at the state level. The doctrine’s development of notions centring on ‘institutional integrity’ and ‘defining characteristics’ of state courts can be explained by the judicial branch trying to retain its own independence. The overall focus of the doctrine, belied by its examination of legislative interferences with state judicial power, is the preservation of the state judiciary. In this vein, it fits ‘hand in glove’ with the legal constitutionalism of the High Court, which focuses on the three branches of government in the absence of any direct individual rights.

**Conclusion**

A pyramid of positivist-textual constitutionalism, multiple political philosophies and historical practice supports the specialised antipodean judicial separation doctrine. An independent judiciary impartially extols the ‘Washminster’ Constitution to achieve the numerous underlying constitutive ambitions: federalism, checks and balances, individual freedom. The adjudication upon the Constitution towards these ends advances a ‘guarantee’ of republican liberalism—the supremacy of law over public power. The guarantee, however, is limited in its pursuit of individual freedoms by the Constitution’s institutional frameworks. The independent judiciary is able to prevent only certain infringements of freedom and uphold particular constitutional rights. The scope, however, for republican liberalism to protect individual freedoms has been further hollowed out by the High Court’s methodological and philosophical choices. The Court has been unwilling to move beyond the positivist-textual constitutionalism, which grounds the separation doctrine to embrace wider common law, constitutional or ‘judicial power’ jurisprudence. This reticence is particularly alarming in the age of ‘securitisation’ when governments seek to increasingly curb individual

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95 *Fardon v Attorney-General (Qld)* (2004) 223 CLR 575, 593 (Gleeson CJ), 617 (McHugh J), 617 (Gummow J), 629 (Kirby J), 652 (Crennan J); *Forge v Australian Securities and Investment Commission* (2006) 228 CLR 45, 76 (Gummow, Hayne and Crennan JJ.
freedoms. Furthermore, the facilitator of this ‘liberty’, judicial independence, has also been reduced in efforts to accommodate governmental functions and enhance the credibility of ‘securitisation’ methods. In 2012, the guarantee of republican liberalism for individuals under the Australian Constitution, as advanced by the judicial separation principles through an independent and impartial judiciary, is limited and increasingly curtailed.

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Here, Do This For Me: The Impact of Delegated Legislative Power on Separation of Powers and the Rule of Law

Gretal Wee

Abstract

In their book, *Australian Constitutional Law: Commentary and Cases* Ratnapala, John, Karean and Koch observed that:

Excessive delegation of legislative power to the executive defeats the purpose of the separation of powers doctrine and may threaten the rule of law by allowing the executive branch to subject the law to its capricious will.

Except for the judiciary’s independence, separation of powers in Australia has not been upheld strongly for both practical and political purposes. The danger highlighted in the quote has thus become very real, leading to a significant question: To what extent does the Commonwealth Parliament’s capacity to delegate its legislative power undermine the separation of powers doctrine and threaten the rule of law? In answering this question, this essay defines the rule of law and separation of powers; examines the reasons behind delegation and its negative impact; identifies and analyses three main ways through which the impact is lessened; and finally evaluates the ultimate effect of delegation after these restraints have been implemented. It concludes by arguing that the delegation of legislative power does not necessarily threaten the rule of law and separation of powers doctrine, and has not done so in practice.

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The doctrine of the separation of powers and the rule of law has long been considered intrinsic to the Australian Commonwealth Constitution. However, the increasing delegation of legislative power to the executive has created concern that these two doctrines are being weakened. This essay seeks to examine the validity of that concern. It will begin by defining the rule of law and separation of powers, outlining the rationale behind these concepts and the link between them. It then proceeds to examine the reasons behind the
delegation of legislative power and the problems caused by such delegations to the aforementioned concepts. Following this, it will examine and analyse the effectiveness of the measures taken to combat these problems. There are three general measures: firstly, the limits the High Court of Australia has placed on the Commonwealth Parliament’s capacity for delegation; secondly, parliamentary scrutiny of the delegated legislation; and thirdly, the constraining of delegated legislation through judicial review. Finally, it concludes by identifying the overall impact these measures have, and to what extent they are capable of preventing the delegation of legislation from undermining the separation of powers and threatening the rule of law.

The rule of law has itself been the subject of many discussions and disputes over its precise definition. For instance, Dicey regards it as simply dictating that the law binds each person within the state, while Lord Bingham perceives it to go beyond Dicey’s ‘thin’ definition to include issues such as human rights and how public officials should behave. For the purposes of this essay, Dicey’s definition will be preferred as being sufficient to clarify the link between the rule of law and separation of powers, while ‘thick’ definitions such as Lord Bingham’s would import normative concepts beyond the scope of this essay. Dicey proffers three defining qualities: the obviating of discretionary law-making; equality before the law; and the availability of judicial remedy if the government flouts the law of the land. Moreover, it creates a ‘certainty and predictability’ that allows people to plan their affairs. This principle was upheld in A v Hayden, in which government officials were found guilty of breaking and entering despite the fact that they were merely following orders, a clear illustration that citizens may rely on the fact that the government is not above the law.

The separation of powers refers to the strict division of the government into three branches: judicial, executive, and legislative. The executive must adhere to and enforce the legislative’s rules while the courts have jurisdiction to implement legal boundaries, thus upholding the rule of law against arbitrary law-making. Intended to create a system of checks and balances between the branches, it thereby prevents the concentration and therefore the potential for abuse of power in one branch.

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6 Meyerson, above n 2.
Ratnapala frames two ways in which the doctrine of separation of powers serves the rule of law. Firstly, the separation between the legislature and the executive subjects the executive government to the law and prevents capricious law-making.\(^9\) Secondly, the independence of the judicial branch from the others prevents legislation, after having been passed, from being manipulated by the executive government to suit itself.\(^10\) In practice, however, the separation of powers is often practised in a less drastic form in which overlaps between the branches are permissible. While the judiciary zealously guards its independence in order to maintain its impartiality and therefore its legitimacy,\(^11\) the legislative and executive are intermingled to a great extent.

Although influenced by the American concept of separation of powers,\(^12\) Australia has never implemented a strict separation between the legislative and executive branches.\(^13\) Aside from the unfeasibility of implementing a strict separation,\(^14\) this is due to the requirement that the two branches be closely linked\(^15\) under the system of responsible government, which dictates that there should be ‘individual and collective ministerial accountability’.\(^16\) The intertwining of the executive within the legislative ensures that the government acts with the approval of Parliament,\(^17\) Cheryl Saunders mentioning that it is generally assumed that the Commonwealth legislature controls executive power.\(^18\) This is arguably acceptable as this intertwining is necessitated by responsible government, one of the core principles of the Australian political system. Of more concern is the increasing delegation of legislative power to the executive government since the 1920s.\(^19\) There are several reasons for this delegation. Parliament lacks the capacity to attend to the smaller details of the law in terms of both time and technical expertise,\(^20\) exacerbated by the fact that Australian parliamentary sittings are generally of a shorter duration than the parliaments of other countries.\(^21\) Delegated legislation has regard more to the minutiae rather than the policy of the law, which remains under Parliament’s

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10 Ibid.
11 Clark, above n 1, 91.
13 Clark, above n 1, 93.
14 Blackshield and Williams, above n 11, 10.
16 Reilly, Appleby, Grenfell and Lacey, above n 3, 139.
17 Ibid 101.
19 Ibid 132.
20 Ratnapala, above n 8. 95.
control. Moreover, the executive branch is better equipped to react promptly to emergencies or quickly changing circumstances, such as enforcing quarantine measures in case of an epidemic, and is also able to pass amendments within a short frame of time.

Necessary though it may be, the delegation of legislative power produces several problems. The executive may establish provisions that infringe the rights of individuals. The delegation further undermines the concept of separation of powers previously weakened by the fact that the executive already has a significant role in enacting legislation by reason of the embedding of the executive within the legislative branch, as specified in s 64 of the Commonwealth Constitution. This results in the executive branch being able to delegate substantial legislative power to itself, which has indeed occurred. Too much delegation could result in the concentration of power in a single branch of government, leaving open the possibility of misuse or arbitrariness. This in turn leads to a lack of the ‘certainty and predictability’ that Friedrich Hayek considered indispensible to the rule of law. Ratnapala also notes that ‘[w]hen officials can both legislate and execute their legislation, they have the potential to place themselves above the law – for the law is what they command.’ Arguably, this does not necessarily flout the rule of law insofar as the delegation remains lawful. Nonetheless, in practice this enables officials to simply create loopholes that they could utilise, or to pass laws enabling them to pursue criminal activities without restraint, for example. Officials are therefore in essence placed above the law. This clearly contravenes the rule of law which states that everyone must be subject to the law of the land. More fundamentally, the consequences of too much delegation may include jeopardising the authority and legitimacy of the law if the elected Parliament allows its legislative power to pass from its hands.

In short, massive delegation of legislative power to the executive blurs the separating lines between the legislative and executive branches, allows for an imbalance between the branches by reposing too much power in the executive, and hence creates the potential for the executive to place itself above the law, undermining the rule of law.

However, steps have been implemented and remedies made available to counteract these problems. The High Court of Australia has placed limits on the

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22 Ratnapala, above n 8, 95.
23 Pearce and Argument, above n 20.
24 Reilly, Appleby, Grenfell and Lacey, above n 3,120.
25 Pearce and Argument, above n 20, 16.
26 Ratnapala, above n 8, 105.
27 Ibid.
28 Meyerson, above n 2.
29 Reilly, Appleby, Grenfell and Lacey, above n 3, 19.
30 Ratnapala, above n 8, 105-106.
31 Meyerson, above n 2.
delegation of legislative power of the Commonwealth Parliament to the federal government. The most fundamental limit is that delegated legislation must come under a constitutional grant of power.\(^\text{32}\) Further limits were established in *Victorian Stevedoring and General Contracting Co Pty Ltd v Dignan*.\(^\text{33}\) In *Dignan*, Dixon J expounded on the first limit, stating that a law made with ‘such a width or such an uncertainty of the subject matter to be handed over’\(^\text{34}\) may be broad enough that it is incapable of being classified, and thus cannot be referred to any legislative power granted to the Commonwealth in the Constitution.\(^\text{35}\) Evatt J ruled that to restrain the Commonwealth Parliament from delegating legislation would be to contradict the supremacy of Parliament.\(^\text{36}\) Hence, the Commonwealth Parliament should have the power to delegate legislation. Nonetheless, a blanket delegation of its power would qualify as an abdication, and would be declared invalid.\(^\text{37}\) This was affirmed in *Giris Pty Ltd v Commissioner of Taxation*\(^\text{38}\) and *Crowe v The Commonwealth*.\(^\text{39}\)

Upon analysis, the delegations excluded by these limits are unlikely to occur in practice, as demonstrated by neither limit having been judicially applied in the past seventy years or so.\(^\text{40}\) These limits have been termed ‘more cosmetic than useful’,\(^\text{41}\) Ratnapala even going so far as to say that *Dignan* established that there were no significant limits on the delegation of legislative power to the executive government.\(^\text{42}\) The second limitation was further tested in *Wishart v Fraser*\(^\text{43}\) when essentially all legislation relating to defence was delegated to the Governor-General and upheld as being constitutionally valid.\(^\text{44}\) Unless restricted to wartime conditions, this effectually abrogates the ‘abdication’ limitation.\(^\text{45}\) The High Court will evidently only decide against the delegation of legislative power in the most extreme circumstances, making their limits rather ineffectual and granting the Commonwealth Parliament near unlimited capacity to delegate its power, resulting in a weakening of the separation of powers.

A second way of controlling delegated legislation is through parliamentary scrutiny. *Obiter in Dignan* stated that political and not judicial remedy would be

\(^{32}\) Reilly, Appleby, Grenfell and Lacey, above n 3, 121.
\(^{33}\) (1931) 46 CLR 73.
\(^{34}\) *Victorian Stevedoring and General Contracting Co Pty Ltd v Dignan* (1931) 46 CLR 73, 101.
\(^{36}\) *Victorian Stevedoring and General Contracting Co Pty Ltd v Dignan* (1931) 46 CLR 73, 119.
\(^{37}\) Ibid 121.
\(^{38}\) (1969) 119 CLR 365.
\(^{39}\) (1935) 54 CLR 69.
\(^{40}\) Ratnapala, John, Karean and Koch, above n 34, 49.
\(^{41}\) Ratnapala, above n 8, 107.
\(^{42}\) Ibid 106.
\(^{43}\) (1941) 64 CLR 470.
\(^{44}\) Ratnapala, above n 8, 108.
\(^{45}\) Ibid.
relevant to the misuse of delegated power,\textsuperscript{46} indicating the link with responsible
government and the executive’s accountability to the legislature.\textsuperscript{47} This
accountability is achieved mainly through two mechanisms: Question Time and
parliamentary committees,\textsuperscript{48} instead of repealing the empowering statute as was
suggested in \textit{Dignan}.\textsuperscript{49} Question Time is a daily event which allows Parliament
to ask questions of executive ministers concerning their programs and policy
decisions.\textsuperscript{50} Ministers are obliged to answer, although complaints as to the
avoidance of answering questions have been made.\textsuperscript{51} They must also present
the relevant documents. In \textit{Egan v Chadwick},\textsuperscript{52} Egan failed to table requested
documents and was disciplined for it; the same procedure may be instituted
by the Commonwealth Parliament against a federal minister.\textsuperscript{53} Concurrently,
parliamentary committees examine proposed laws, ‘consider issues of policy and
scrutinise the conduct of the [e]xecutive’.\textsuperscript{54} For instance, the Senate Standing
Committee on Regulations and Ordinances (SSCRO) ensures each delegated
instrument adheres to the original statute; respects individuals’ rights; and does
not encroach upon the territory of parliamentary enactment, to name a few
criteria.\textsuperscript{55} It is further capable of recommending that a provision be disallowed,
which, although rarely used, has been followed by the Senate. However, the
SSCRO does not consider the policy merits, concentrating more on the form and
quality of the legislation.\textsuperscript{56} Despite this, committees in general have enforced
limits on the executive’s discretionary law-making.\textsuperscript{57} The Commonwealth
Parliament has also enacted the \textit{Legislative Instruments Act 2003} (Cth) requiring
delegated legislation to be reviewed.\textsuperscript{58} Such legislation will not be effective until
it has received parliamentary approval, or remains effective until disallowed by
the Parliament.\textsuperscript{59} However, the sheer volume of delegated legislation reduces
the effectiveness of parliamentary scrutiny,\textsuperscript{60} while committee reports are often
given limited attention.\textsuperscript{61}

On the whole, the committees do implement protective measures against
uncontrolled and overly discretionary delegated legislation while Question

\begin{footnotesize}
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\item \textsuperscript{46} \textit{Victorian Stevedoring and General Contracting Co Pty Ltd v Dignan} (1931) 46 CLR 73, 84.
\item \textsuperscript{47} Ratnapala, above n 8, 107.
\item \textsuperscript{48} Reilly, Appleby, Grenfell and Lacey, above n 3, 136.
\item \textsuperscript{49} Saunders, above n 17, 132.
\item \textsuperscript{50} Reilly, Appleby, Grenfell and Lacey, above n 3, 103.
\item \textsuperscript{51} Ibid.
\item \textsuperscript{52} \textit{Egan v Chadwick} (1999) 46 NSWLR 563.
\item \textsuperscript{53} Reilly, Appleby, Grenfell and Lacey, above n 3, 101.
\item \textsuperscript{54} Ibid 104.
\item \textsuperscript{55} Pearce and Argument, above n 20, 27.
\item \textsuperscript{56} Ibid 28.
\item \textsuperscript{57} Ibid 15.
\item \textsuperscript{58} Ratnapala, John, Karean and Koch, above n 34, 51.
\item \textsuperscript{59} Pearce and Argument, above n 20, 17.
\item \textsuperscript{60} Ratnapala, above n 8, 95.
\item \textsuperscript{61} Reilly, Appleby, Grenfell and Lacey, above n 3, 107.
\end{itemize}
\end{footnotesize}
Time allows for some scrutiny. Yet it should be noted that Parliament may be incapable of impartially judging the executive's actions due to the politics of mega-parties, seriously undermining the effectiveness of parliamentary scrutiny. Ultimately, however, the executive is still subject to legislative control. This element of control upholds the rationale behind the separation of powers, which intended for the legislature to be capable of restraining abuse of power — such as arbitrary law-making — by the executive branch.

The third mechanism for controlling delegated legislation is by judicial review. A distinction must be drawn between the High Court's invalidating legislation based on too substantial a delegation of legislative power and its invalidation of legislation due to bad law. While the High Court has clearly demonstrated a reluctance to strike out legislation because of the former rationale, it is willing to do so on the latter grounds. McEldowney v Forde\(^63\) established a test for determining the validity of delegated legislation: the court must establish the meaning of the words used in the delegating Act to describe the legislative power delegated; the meaning of the delegated legislation; and lastly determine whether the former corresponds with the latter. This was affirmed in Esmonds Motors Pty Ltd v Commonwealth,\(^64\) in which the delegated legislation was voided. Apart from invalidating legislation, the judiciary may also import limits into the delegated legislative power, the limits being determined from the scope and purposes of the Act,\(^65\) thus giving it the capacity to restrain arbitrary law-making should it occur. However, the courts are fettered by their ability to only hold the executive to the legal standards which the executive has created.\(^66\)

In conclusion, the delegation of legislative power by the Commonwealth Parliament to the executive government blurs the separation of powers, creating the potential to allow for arbitrariness in law-making which in turn undermines the rule of law. The safeguards put into place (such as parliamentary scrutiny, judicial limitations on the extent of delegation, and judicial review) each have weaknesses, their ability to constrain the abuse of delegated legislative power rather ineffective. However, while the potential for abuse is little abated, actual abuse has not yet taken place\(^67\) in terms of infringement on human rights or a lack of stability and certainty in the law, for example. Should it do so, the Commonwealth Parliament still retains the power to withdraw legislative power from the executive\(^68\) while the judiciary is capable of striking out bad law via judicial review. Thus, while the delegation of legislative power does pose a

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62 Ratnapala, above n 8, 110.
63 [1969] 2 All ER 1039, 1068.
64 (1970) 120 CLR 463, 366.
66 Ratnapala, above n 8, 109.
67 Pearce and Argument, above n 20, 14.
68 Ibid 7.
potential threat to the rule of law and the separation of powers, such a threat
has not yet been realised and is capable of being nullified if and when it does
materialise.

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