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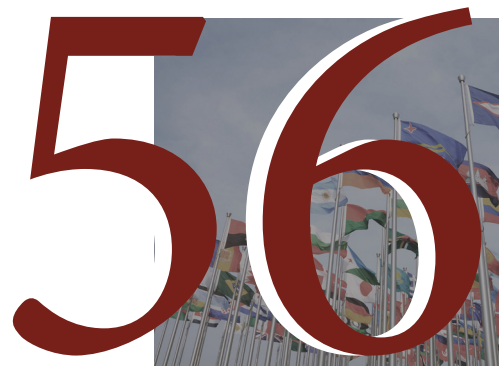
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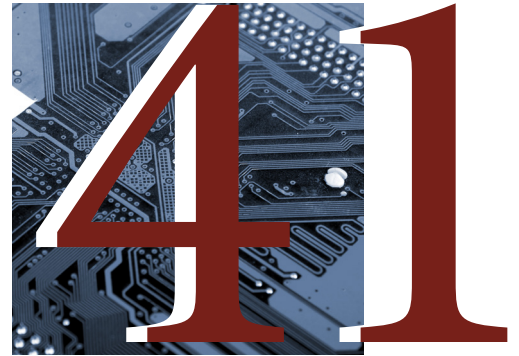
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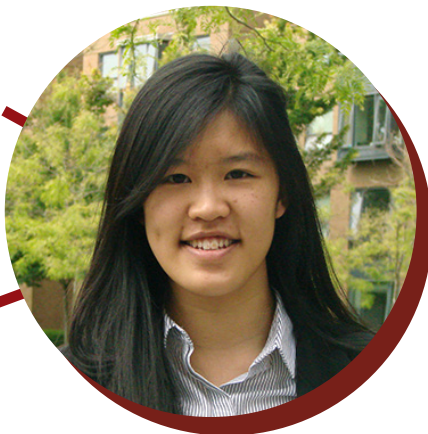




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Letter from the editors

Supporting undergraduate research not only enriches the educational experience of students but also benefits faculty, universities, and our society as a whole. By investing in undergraduates, we can help students develop vital critical thinking skills and an intellectual curiosity that will support them in the endeavours they pursue after their degree. At CJUR, we aim to support these students by providing them with opportunities to share their work and to develop their communication skills.

Since our inaugural issue in April 2016, we have received immense positive feedback from numerous stakeholders in the academic community confirming the need for our initiative. We received a 125% increase in submissions relative to last year's edition and we hope to continue this growth moving forward. We have moved our submission process to the Open Journal System software by the Public Knowledge Project, enabling a robust editorial workflow that emulates professional peer reviewed journals. Faculty members from universities across Canada have taken notice of our platform and now actively encourage their students to submit. This issue contains submissions from the University of British Columbia, University of Toronto, University of New Brunswick, University of Waterloo, University of Ottawa, and Simon Fraser University. We hope that through continued hard work, CJUR will continue to grow over the coming issues and years.

In this issue, we discuss a diverse range of salient issues facing our world today, from the impact of refugees on Europe's open border agreements to the development of algorithms that identify loudness in audio signals. It is encouraging to see the impact that undergraduate students are having in these areas and I hope you will join us in celebrating their work.

Sincerely,

Editorial Team at the Canadian Journal of Undergraduate Research

THE GOOD AND BAD IN HUMANITY

Bryony Claire Pratt

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In a bleak world with no hope or morals, mankind loses touch with its humanity. An understanding what it is to be human becomes blurred, and defining humanity to a child who has only known such a world is difficult. Cormac McCarthy explores these ideas in *The Road*, a post-apocalyptic novel that tells the story of a father and son's journey through ruined America, where the boy tries to make sense of what is good and evil in a landscape filled with destruction and chaos. The father imparts knowledge of the former world to the boy, and defines humanity in the best way he can by dividing the remnants of it into two groups: the good guys and the bad guys. This worldview allows the boy to challenge his father's perspective of humanity, and transcend its black and white boundaries, ultimately enabling him to survive the harsh world without his father.

In his attempts to define humanity, the father tells his son stories of the world's former goodness in relation to the bad people and devastation in their current surroundings. By creating a clear line between good and bad, he instills a method of survival that holds both of them accountable for their actions as they struggle to stay alive on the road. He hopes that his son will grow up with morals and have survival skills to fend for himself when he can no longer be there for him. He tells the boy "[o]ld stories of courage and justice as he remembered them" so that his son will know that there is still hope, even amongst the miserable landscape through which they trek (McCarthy 41). The boy understands these stories as being good, and the father juxtaposes this concept to the evil people who are also on the road. An example of bad guys is shown when they cross paths with a group of truckers, one of whom threatens to kill the boy if the two of them do not follow him, presumably to be eaten. The father shoots the man to protect his son, and explains to the boy why he did so:

You wanted to know what the bad guys looked like. Now you know. It may happen again. My job is to take care of you. I was appointed to do that by God. I will kill anyone who touches you. (McCarthy 77)

The confrontation allows the boy to see that bad guys do exist, and also establishes that he and his father are the good guys. Julian Murphet and Mark Steven explain in their book, *Styles of Extinction: Cormac McCarthy's The Road*, that the "belief that they are the good guys is explicitly linked to the existence of God when the father says that his job is to take care of the child" (Murphet and Steven 138). By declaring that God chose the man to look after the boy, the boy can understand past morals where humans followed God, and can therefore associate himself and his father as being the good guys. The father passes on this understanding to give hope for the boy, even though there is none left for himself. This ironic contradiction within the father becomes apparent as they journey alone together down the road, causing the boy to start questioning some of his teachings.

There are times throughout their journey where the boy tries to accept his father's concept of the world being split between good and bad; he learns to understand that the rules for being a good guy depend on the situation. Erik J. Wielenberg discusses the rules the father and son associate with good guys in his analysis, "God, Morality, and Meaning in Cormac McCarthy's *The Road*." He describes the novel as having a Code of the Good Guys, where "there is a simple rule for distinguishing the good guys from the bad guys. Bad guys eat people; good guys don't" (Wielenberg 5). This code that both father and son commit themselves to includes not stealing, helping others and never giving up (Wielenberg 5-6). As the father and son look for food and supplies and try to stay safe, the boy recognizes situations where they are unable to strictly obey their code of con-

duct. This is seen when they cannot help the naked people who are trapped in a basement, waiting to be eaten. Both father and son flee when they hear the cannibals returning, and the boy states later that “[they] couldn’t help them because then they’d eat [them] too,” demonstrating that he understands that it is not always possible to behave like a good guy (McCarthy 127). The boy also learns that it is fine to take from others if they are no longer alive, and the father insists that this form of taking is not stealing. Although the boy agrees, he does not fully accept that it is right to take from others, and decides to thank them:

Dear people, thank you for all this food and stuff. We know that you saved it for yourself and if you were here we wouldn’t eat it no matter how hungry we were and we’re sorry that you didn’t get to eat it and we hope that you’re safe in heaven with God. (McCarthy 146)

Once again, God is associated with goodness, for the boy hopes that the good guys that left the food and supplies are with him in heaven. By thanking the people before them, the boy transcends his father, showing that there can still be goodness in situations where the line between right and wrong is blurred. As the novel progresses, it becomes increasingly difficult for the father to abide by the code that he himself created, causing the boy to dispute his ideas.

The boy challenges the dualistic worldview when his father strays too far away from what it means to be a good guy, showing that he is capable of evaluating for himself the right course of action. The boy constantly asks his father to help desperate people they meet on the road, which creates tension between them. Steven Frye, author of *Understanding Cormac McCarthy*, states that the conflict that arises between father and son is due to the father being “willing to violate moral principle to ensure their survival” (Frye 170). This goes against the boy’s understanding of good guys, “a status [he believes] they can rightfully claim only if they give food to the hapless outcasts they occasionally meet” (Frye 170). Ely, an old man they come across on the road is one of these outcasts, and the boy has to convince

his father to give him some of their food. Just as the boy had thanked the dead people for the food they left behind, the father tells Ely that he should thank the boy, for he “wouldn’t have given [Ely] anything” (McCarthy 173). This reveals his son’s good nature, which the man seems to have lost during their long journey on the road. A major point of conflict occurs when the father and son catch the thief who stole their shopping cart and campsite supplies while they were walking down the coast. The father punishes the thief for taking what little they had, demanding that the man remove his shoes and clothes or be killed. He remains firm, despite his son’s pleas to “[j]ust help him,” and when he does give in it is too late – the man is gone, and they have to leave his shoes and clothes in a pile under a rock (McCarthy 259). In response to his father explaining that he was not going to kill the thief, the son replies that “[they] did kill him,” implying that if they had let the man keep his clothes and had given him some food, he would not be left alone to surely die (McCarthy 260). The build up of tension as the boy challenges his father culminates in this moment, as he is now certain of the flaws in his father’s theory of good and bad. By attempting to remain one of the good guys, the boy shows that he no longer requires his father to determine right and wrong for him.

The boy fully transcends his father and his limited good guy and bad guy perspective when he is left to survive on his own; he still takes their rules of conduct into account but knows that the world cannot be strictly divided into two boxes. Before the father dies, he tells his son that he has to find the good guys and continue to carry the fire that is inside of him. His son asks about the little boy he thought he had seen earlier in their journey, and the man reassures him by saying that “[g]oodness will find the little boy,” for it has and will again (McCarthy 281). These are the father’s last words, and it is suggested that the little boy he is talking about is actually his son. A few days after his father’s death, the boy encounters a “veteran of old skirmishes, bearded [and] scarred across his cheek,” who invites him to join his family (McCarthy 281-282). From his appearance, the boy should be scared of this man, who fits into his father’s description of bad guys, but instead allows the man to approach him. He is still cautious, pointing the pistol towards

the man and questioning to see if he is “one of the good guys” (McCarthy 282). After being certain that the man does not eat people, the most obvious sign of being a bad guy in their world, the boy agrees to go with the man and his family along the road. His confidence and ability to trust the man shows that the boy is able to do what the father could not—find goodness on the road, even if it does not completely align with their moral code of good guys and bad guys.

Overall, Cormac McCarthy’s *The Road* presents a unique perspective of humanity, one that is split between good guys and bad guys. The man in the novel conveys this worldview to his son on their rough journey on the road, so that the boy can understand what goodness is, even while in a barren land that does not seem to offer any kind of future. Although the boy accepts the moral code, he is confused by his father’s inability to follow the guidelines of being a good guy, especially when he refrains from helping others. As they journey further and further along the road, their relationship becomes tenser as the boy discovers that his father’s dualistic perspective of humanity is too plain and simple in being comprised of good guys and bad guys. The boy expands the boundaries to extend and accept acts of goodness from people who may not be entirely good, as seen by his efforts to help the thief, and when he chooses to join the stranger’s family after his father dies. The ability to transcend these boundaries gives the boy strength to survive in the post-apocalyptic world without his father, which suggests that there is hope for those who are willing to see and risk their lives for a future.

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REFUGEES AND OPEN BORDERS: HOW SUSTAINABLE IS THE SCHENGEN AGREEMENT IN EUROPE?

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ABSTRACT

The Schengen Agreement has been a prime example of European integration, providing citizens of member states the unique experience of travelling across borders without the inconvenience of border checks. However, the recent peak in the flow of refugees and a changing political environment has challenged the agreement and put the future of open borders in Europe into question. This article initially establishes the background on the Schengen and Dublin conventions, the benefits they have brought to member states, and the role they have played in European integration. Subsequently, the challenges brought by refugees and the reactions of European nations are discussed and finally, the attempts by members to address the current challenges are assessed. In summary, I argue that the situation can only be resolved with political will from all member states in order to make the tough decisions required to maintain an achievement that was itself reached after a collective effort by all member states. There is also a need to realize the extra burden that frontier states are bearing and the need for sharing the responsibility of any collective decision. Inaction or counterproductive measures would either challenge the moral responsibility of the EU in protecting those risking their lives to reach its shores or result in the end of a borderless Schengen zone. Both scenarios are undesired, underscoring the importance of robust, collective action.

INTRODUCTION

The instability of the Middle East, in particular the war in Syria, has led to massive flows of refugees to Europe (Aussilloux and Le Hir 2016). In 2015 alone, there were around 1.2 million asylum seekers mostly originating from Syria, Iraq and Afghanistan, indicating a steep rise from 620 thousand refugees in 2014 and 2013, respectively (Aussilloux and Le Hir 2016). More than three decades have passed since the signing of the initial Schengen agreement, and almost two decades since it came into full force. The Schengen area of free movement is widely considered to be one of the most important achievements of European integration (Novotná 2015). A visible outcome is that in continental Europe, people are used to crossing borders within the Schengen area without ID checks (Gros 2015). While many Europeans may have grown accustomed to the concept of open borders, implementation of an agreement that removed all border checks was an incredibly bold step for its time and critical to further integration within the European continent.

However, this important symbol of European integration has had its fair share of challenges, especially over the past years. Part of this stems from the unequal balance in the burdens of open borders; for example, Germany, Hungary, Austria and Sweden have had to deal with the majority of the refugee influx (Aussilloux and Le Hir 2016). Since 2015, Austria initiated border patrols and built a fence along its border with Slovenia, a fellow Schengen treaty member (Aussilloux and Le Hir 2016). Hungary and Germany also initiated border checks while France took the same course of action following the November 2015 Paris attacks (Aussilloux and Le Hir 2016). The closure of borders

around Europe defeats the original purpose of the Schengen Agreement. Following the refugee crisis, policy makers, scholars, and even the general public are questioning the future of open borders in Europe. In this article, I will explain the making of the Schengen agreement and its importance as a core achievement of the European Union. Subsequently, I will draw upon the challenges that the Schengen and Dublin agreements are facing as a result of geopolitical situations and how these challenges can result in the failure and potential collapse of the Schengen agreement. Finally, I will discuss efforts by EU states to address those challenges and argue why the Schengen, from political, economic and symbolic stand points, is too important for European integration to fail.

AN INTRODUCTION TO THE SCHENGEN AND DUBLIN AGREEMENTS

Schengen Agreement

The ability to control one's borders is a key aspect of sovereignty and it had been a cornerstone of the politics that led to wars in Europe. The Schengen Agreement of 1985 and the convention of 1990 which brought it into force was an attempt by European nations to abolish internal borders while making a collective attempt to strengthen the external borders of what was to become the Schengen zone (Bauder and Matheis 2016). This led to the concept of the European external border as a new concept that was institutionalized and developed into a field of European policy (Bauder and Matheis 2016). The fact that European nations were willing to give up a major aspect of their sovereignty for the purpose of further integration within Europe makes the Schengen Agreement one of the key achievements of the European project. The tangible effects of the Schengen Agreement, including the exchange of information on criminal activity and free movement across borders resulted in a deepening and widening of cooperation which led to its inclusion into the legal framework of the European Union (McCabe 2016).

Since the signing of the Schengen convention, numerous rules and regulations have been compiled for the Schengen area. These are collectively known as the Schengen acquis (McCabe

2016). The Amsterdam Treaty of 1997 incorporated the Schengen Agreement into EU law and transferred migration and border policy to the European level (Ghimis et al. 2016)(Bauder and Matheis 2016). This led to a combination of 5 European legislative acts on migration that resulted in the Common European Asylum System (CEAS) with the intent of harmonizing the asylum process within EU member states (Bauder and Matheis 2016). In a legal sense, the Schengen convention no longer exists by itself, so aside from the exceptions made for Denmark, the UK and Ireland, leaving the Schengen Agreement means leaving the EU (Ghimis et al. 2016).

Following the removal of borders within Europe, common immigration practices had to be established among member states. As a consequence, entry visa requirements were harmonized across the Schengen zone and the Schengen Information System (SIS) police database was established (Bauder and Matheis 2016). Following the institutionalization of common practices in issuing visa, controlling borders and judicial matters, the SIS has acted as the core security feature that compensates for the lack of completely unified air and borders controls (Rotman 2012). SIS allowed the sharing of third-country citizen information among participating nations and this included migrants and refugees (Rotman 2012). SIS was later complemented by Eurodac, a pan-European database established in 2003 for the sole purpose of tracking irregular migrants and asylum seekers (Bauder and Matheis 2016).

Econometric analysis has shown the Schengen Agreement boosts trade by more than 3% with a higher effect on goods than services (Felbermayr, Gröschl, and Steinwachs 2016). Establishing visa liberalization regimes with the Schengen area and neighbouring countries has also served as a valuable tool for EU foreign policy in pressing for democratic reform in the course of negotiations over visa regime liberalization (Ademmer and Delcour 2016). Security was one of the main issues raised with the removal of internal borders within Europe. In the event of threats to national security, the Schengen acquis allows for internal border protection if member states deem necessary (McCabe 2016), however there are time limits to such mea-

tures as I will touch on further.

The Dublin Agreement

The Dublin framework was signed in 1990 by 12 signatory European nations and it came into effect in 1997 (Bauder and Matheis 2016). The importance of the Dublin framework and its inclusion in the article is that it determines the country responsible for processing asylum applications. Articles 28-38 of the Dublin convention that are regarding the responsibilities towards asylum seekers were copied directly from the Schengen convention which was signed four days after (Bauder and Matheis 2016). The Dublin Convention was followed by the Dublin Regulation which is now a core element of the European Union's internal security acquis (Thielemann and Armstrong 2013). The Dublin System/Regulation is at the centre of discussions of European policy regarding asylum applications, which has been highlighted in the recent refugee crisis.

The Dublin agreement effectively puts the responsibility for processing asylum claims to the state that has caused the entry of asylum seekers by insufficient policing or improper issuing of a visa (Bauder and Matheis 2016). Importantly, the Dublin system focused more on the country that has "caused" the entrance of asylum seekers into the Schengen area while there is an absence of fixed quotas for allotting the burden of processing asylum applications among member states (Bauder and Matheis 2016). Given that countries on the periphery of the EU, such as Greece or Italy, where external borders are located, are more likely to be the port of entry for asylum seekers which leads to them being laid the responsibility of processing applications under the Dublin system. This unequal distribution has led to heated debates within the EU on the effectiveness of the Dublin system.

In order to deal with waves of asylum seekers, the discussion of sending them to "safe" third countries began in the 1980s in an attempt to curb migration to Europe (Bauder and Matheis 2016). The consequence was that applicants transferring through a country that provided protection to refugees under international law, specifically under the Geneva convention on refugees, could be deported to those safe countries to apply for asylum (Bauder

and Matheis 2016). The legal assumption has been that all EU member states are considered safe, thus deportations within EU states is not considered a violation of the non-refoulement principle of the Geneva convention on refugees (Bauder and Matheis 2016). Under article 18 of the more recently revised Dublin III regulation, an electronic communication network called "DubliNet" was set up, which provides Member States an electronically signed and encrypted platform to share and exchange information on the movement of asylum seekers within the Schengen area (Juardo et al. 2016).

The chronological order of the Schengen and Dublin conventions demonstrates a clear anxiety about strengthening external borders of the Schengen area as internal borders are broken down (Rotman 2012). In 2005, Frontex, the European Agency for the Management of Operational Cooperation at the External Borders of the Member States, was established to promote and coordinate the management of external borders and by 2010 its budget had increased 15-fold to 90 million euros (Rotman 2012). Given the highly disproportionate distribution of costs and benefits among member states, with some member states experiencing much more of a burden as a European frontier, it is quite significant that the Schengen and Dublin conventions have been able to survive this far (Thielemann and Armstrong 2013). Expanding on the various conventions and frameworks developed within the last three decades from the Schengen and Dublin agreements is outside the scope of this article, however the trend demonstrates the challenges of maintaining open borders given the anxieties that exist within governments and among the public and act as a foundation for the challenges at hand.

CURRENT CHALLENGES WITH THE SCHENGEN AGREEMENT

Refugees and Geopolitical Challenges to the Schengen and Dublin Frameworks

The issue of migrants and refugees has long been on the European agenda. The definition of refugees is highly contested (Juss 2006) and public perception of the issue has shifted over time. The 1970s saw significant numbers of non-European refugees, which topped in the eighties but paled in

the 1990s in comparison to almost 3 million refugees from the Yugoslav wars (July 1996). Incomers are usually divided into asylum seekers or refugees, as defined by the 1951 Geneva Convention on Refugees, or economic migrants (July 1996). It is important to recognize the historical context of the 1951 Geneva convention, as it was while the memories of the Second World War and the persecution of fascism was vivid, while the emergence of communist regimes in Eastern Europe had displaced many Europeans (July 1996). However, the recent wave of refugees has shown a shift of smuggled migrants from those with a less likelihood of receiving a positive response to their asylum application to those with a higher likelihood of success (Fargues 2015).

One of the main issues that often comes up alongside the discussion on waves of refugees and the challenges they pose to the integrity of the Schengen area is the dimension of opposing human trafficking. As the definition of “trafficking in human beings” (THB) is the transnational crime of moving people across borders, strict control of borders is identified as the key method of controlling the problem (Rusev 2013). Frontex identifies THB as one of its top priorities, resulting in efforts to harmonize Schengen border protocols to deal with the matter (Rusev 2013). While on one hand it seems that strict border controls are the logical path to containing TBH, strict immigration policy can push many towards human trafficking (Rusev 2013). Given the economic and political prosperity within the EU compared to its neighbours to the east and south, human trafficking will always remain a key challenge for a Europe without internal borders. The instability in the Middle East only adds to this serious challenge and fighting human trafficking is a common argument for enforcing strict border codes while clearly the solution is a finer line in immigration policy.

Clearly, the geopolitical situation in the Middle East is shaking the core of open borders within the European Union in direct and indirect ways. The Arab Spring created new levels of challenges for the Schengen agreement. As headlines broke in 2011 about overcrowded migrant boats sinking in the Mediterranean Sea, a sense of heightened alert-

ness was felt in Europe. While the numbers of migrants flowing into Europe were not completely out of the ordinary, the fact that it was happening as the Arab Spring was sweeping North Africa caused Italy to declare a state of emergency followed by France closing its borders with Italy (Rotman 2012). The situation was eventually resolved by EU member states as they reaffirmed their commitment to the Schengen Agreement (Hatton 2016). Nonetheless, it was clear that the conflict of interests among member states posed a serious problem that could jeopardize the future of open borders in Europe. Many point the finger of blame for the existing challenges to the conduct of Greece in enforcing strict control of the external border of the Schengen area. However, such an argument is rather hypocritical given that the country has 1200 islands and does not have a common border with any other Schengen states, therefore all its borders are subject to border checks (Ghimis et al. 2016). This yet again highlights how the disproportionality in responsibilities is damaging the integrity of the Schengen and Dublin Frameworks.

Disagreements in the Extent of the Challenge

The Syrian exodus has brought the European refugee asylum system (notably the Dublin Framework) into chaos and led to polarized debates within Europe (Hatton 2016). Until now, most states have not recognized the legal obligation to take in these refugees, however public statements from national leaders demonstrate that most states do recognize the moral obligation to do so (Lambert 2016). Given the high stakes for human rights, it is even argued that moral obligations can be given normative force to have a legal dimension (Lambert 2016). This is mostly due to the geopolitical situation in countries like Syria, Libya, Iraq and Afghanistan, making the argument that most refugees are actually economic migrants less and less acceptable. In such a scenario were rejecting asylum applications is encountering legal and moral challenges, more and more pressure is being put on the first point of entry for these refugees. The transfer request under the Dublin framework clearly favour the more wealthier core member states at the expense of those with external borders (Thielemann and Armstrong 2013). This has again put the spotlight on the inherent dis-

proportionality in the distribution of responsibilities within the Dublin framework and the need for fundamental reform in that regard.

Many scholars criticise the exaggerations made for the challenges at hand. Guild et. al. (2015) argue that the language of crisis for the challenges with migration, refugees and border controls is over-seeing the fact that 320 million foreigners entered the Schengen area peacefully and that countries that temporarily introduced border control did so according to articles 23-25 of the Schengen Border Code (Guild et al. 2015). However the real challenge is ensuring that member states continue to enforce Schengen borders consistent with their obligations under International law towards refugees and consistent with the right to non-discrimination enshrined in the EU Charter of Fundamental Rights (Guild et al. 2015).

It is also important to consider that a violation of the Schengen Treaty by reintroducing internal borders is also a violation of EU law. The texts of the Treaty of European Union (TEU) and the Treaty of Functioning of the European Union (TFEU) clearly state that threats to leave the Schengen by permanently restoring internal borders must also leave the EU altogether (Ghimis et al. 2016). While there may be disagreements in the extent of the challenge, whether it is the claim that the “Schengen is under attack” (Gros 2015) or simply undergoing a challenging period, there seems to be agreement in the fact that there is a tough road ahead both in political terms and in public perception for the future of Schengen.

WHY THE SCHENGEN AGREEMENT IS TOO IMPORTANT TO FAIL

Consequences of a Weakened Schengen Agreement

The Schengen agreement remains one of the main accomplishments of the EU, not only having high value as a source of European identity, integrity and solidarity, but with substantial economic importance. Even short-term disruptions in open borders can have significant negative economic impacts on EU member states. The freedom to live and work wherever in the European Union has been one of the most, if not the single most, important principle of the European project (Juss 2006).

While the freedom of movement is not necessarily tied to the Schengen Agreement, it is facilitated by it (Aussilloux and Le Hir 2016). A roll back of the Schengen Agreement can have severe consequences on the freedom of movements, goods, services and economic activity in general (Aussilloux and Le Hir 2016). The implementation of border controls, would not only be costly due to the implementation of those restrictions but would result in heavy traffic jams and a reduced number of travelers, affecting tourism within the Schengen zone (Aussilloux and Le Hir 2016). This means negative impacts on the number of tourists, cross border commuters and import/export freight costs (Aussilloux and Le Hir 2016). If the Schengen Agreement were to be removed, bilateral trade among members would drop by 10% with an average GDP reduction of 0.8%. Most importantly, however, it would cast a shadow on the whole European project (Aussilloux and Le Hir 2016). With such dire consequences, it is not surprising that Schengen member states have taken numerous steps to maintain the Schengen Agreement despite the significant obstacles it faces.

EU ACTIONS TO SAVE THE SCHENGEN AGREEMENT

It is important to understand the underlying mentality of EU actions to deal with the refugee crisis. The EU has resorted to “extra-territorialism” to address the issue of migrants to maintain open borders in Europe (Rotman 2012). This is effectively “policing at a distance” as the EU tries to contain the flow of refugees outside its borders by creating extraterritorial buffer-zones (Rotman 2012). Such actions can be seen as efforts to circumvent the 1951 Geneva Convention on Refugees, which provided the right of protection from persecution and refoulement to asylum seekers (Rotman 2012).

It is important to note the context of the 1951 convention, as during that historical junction most refugees were those fleeing from the communist bloc and thus were of important political, ideological and even economic value (Rotman 2012). This mentality about asylum seekers clearly shifted after the breakup of the Soviet Union. Turkey has been a prime example of such buffer zones for the Syrian refugee crisis as it is geographically bridging the

EU with crisis zones in the Middle East. There is no doubt that European leaders face a tough choice between acting as a moral compass by accepting refugees with open arms or by scrambling to maintain one of the key accomplishments of the European project, open borders. As time passes, the internal politics of many European countries and the rise of Eurosceptics is further complicating the situation and forcing policy makers to choose the latter.

The Greek case has been one of the most important milestones of the Dublin Agreement for the first time, as it involved an EU member state dropping out of the Dublin framework for the first time (Bauder and Matheis 2016). Given the geographic positioning of Greece, it has been the bottleneck of incoming asylum seekers from the Middle East. The Greek asylum system was effectively approaching the issue of asylum by evading the asylum applications and urging refugees to move on to Northern Europe (Bauder and Matheis 2016). Given the worsening economic situation in Greece over the past few years, asylum seekers have less motivation to stay in Greece and a stronger urge to move north towards more economically prosperous nations such as Germany. As the effectiveness of Eurodac sharpened, the situation began to change, with more refugees being tracked and deported back to Greece (Bauder and Matheis 2016). This leaves policy makers with a key question on how to preserve the fundamental rights of refugees that are enshrined within the democratic institutions of the EU while also maintaining a robust external border.

One of the key responses to the refugee crisis in order to save the Schengen Agreement was the December 2015 announcement by the European Commission to create a European Border and Coast Guard (Fargues 2015). While this response would be understandable for some, it is criticized by others for mistaking refugees with invaders. Given that Europe's Mediterranean shore holds the title of "the world's most lethal border" (Fargues 2015), one would question many of the current attempts to strengthen European borders, given that so many people are willing to make such a perilous journey to Europe. There is consensus among governments that economic migrants can be deported, but for those seeking persecution, is there not a legal duty

to keep them until their asylum applications are adequately processed? (Fargues 2015).

On the other hand, it is quite apparent that to save the Schengen Agreement, a comprehensive solution must be found to ease the burden from the refugee crisis. Hatton (2016) argues that a tightening of border controls is needed in the long term to move away from the current system of spontaneous asylum migration, but this must be accompanied by a comprehensive settlement program that allows all members to share the burden and an expansion of capacity to host refugees (Hatton 2016). Consequentially, it is important to work with the grain of public opinion rather than against the general sense of anxiety, otherwise the political backlash could lead to accepting far fewer refugees if any at all (Hatton 2016). However, the argument that stricter border controls are the only solution has often been countered by other European scholars. Another solution commonly expressed is dealing with the smugglers that facilitate these large waves of refugees. However, this could either make the journey to Europe even more perilous for the refugees or trap them in war zones (Fargues 2015). This leaves that the moral solution, continuing to accept refugees and showing political will in dealing with the situations that result in the flow of refugees, rather than how they are reaching European borders.

As a result of the many obstacles that parties to the Schengen Agreement are facing, the last few years have seen major revisions and transformations of the agreement. In 2011, as thousands of Tunisian asylum seekers were arriving on the shores of the Italian island of Lampedusa following the turmoil from the Arab Spring, the Italian government asked the EU for help in managing the difficult situation (Pascouau 2013). However, the EU did not share Italy's viewpoint on the severity of the situation and an offended Italy started issuing travel permits to the refugees allowing them to travel throughout the Schengen area, especially to France (Pascouau 2013). As a result, the French government started enacting police controls on its border with Italy, effectively limiting the freedom of movement (Pascouau 2013). In this scenario, both countries were challenging the freedom movement that had resulted from the Schengen Agreement and thus saw the need to address the issue. Both

countries subsequently sent a request to the European Commission to revise the Schengen governance and that was responded with unusual speed (Pascouau 2013).

Two years of intense negotiation and legislation from the EU parliament led to a transformation of the Schengen governance in two key ways (Pascouau 2013). This tense period revived questions about national interests and the power of the European Commission and while the member states made sure to protect their public policy rights, the Commission gained a greater role in Schengen governance (Pascouau 2013). The “Schengen Governance Package” which resulted, called for solidarity among member states in temporarily imposing internal border controls in the event of challenges with managing external borders (Novotná 2015). The transformation included two key areas, firstly a clarification in when internal borders can be introduced after evoking a “sovereignty clause” that had previously existed, effectively making its implementation more difficult by bringing it further under the control of EU law (Pascouau 2013). The amendments set out the circumstances, grounds and time limits for which member states can implement internal border controls (Guild et al. 2015). Secondly, changes in the Schengen evaluation mechanism meant that there was a new definition for the role of the Commission in the mechanism (Pascouau 2013). The Schengen Governance Package has been the most significant change made to the agreement in response to the refugee crisis, but it seems to avoid the major changes that many demand.

The revised Schengen governance falls short of addressing the main solution: further solidarity among member states and the sharing of burden at times of crisis. Currently, the only agreements covering those issues, such as the European Pact on Immigration and Asylum and the Stockholm program are non-binding (Novotná 2015) and clearly do not have the required impact. Europe even has a legal instrument for a mass influx of refugees called the EU Temporary Directive, but a lack of political will and fear of a promoting more migration has led to the instrument remaining inactive (Lambert 2016). The current ad hoc resettlement clearly is not working and there needs to be a sharing of the burden

among all member states based on GDP and population (Novotná 2015). While such a solution would certainly meet stiff opposition from many member states and result in deep disagreements.

It is important that the Schengen Governance Package be seen as what it is, a document to clarify the rules governing the re-imposing of internal borders and to assure it is not abused by member states (Novotná 2015). It is clear that addressing the issue of internal borders is a key step. However, it fails to address the core issues that are resulting in member states reintroducing border checks. As the former foreign minister of Luxemburg, who was present at the original signing of the agreement in Schengen, Luxemburg put it, “Schengen is not the reason why Europe is currently in such a difficult situation. The real reason is the lack of cooperation, solidarity and political will” (Ghimis et al. 2016). The majority of European scholars believe that the fundamental issues at hand are not being addressed. As Bauder and Matheis (2016) put it eloquently, the current rationale seems to be: “Yes, refugees should receive protection, but no, not in my neighbourhood” (Bauder and Matheis 2016). This again highlights one of the key values that have brought European nations together, solidarity and the sharing of responsibility. That is the example member states must follow in the light of these challenges, with those values, it is possible to maintain a Europe without borders with failing the moral test of accepting those seeking refuge.

CONCLUSION

The key question is: how far would the EU go to maintain the Schengen framework? Obviously, there is no straightforward answer. However, the consequences of inaction seem clear. If the Schengen Agreement is to remain a prime example of EU solidarity and the success of European integration, tough choices must be made to maintain it in light of the many challenges that it faces. This includes the acceptance by all member states that in order to benefit from open borders within Europe, there is a price to pay and that includes sharing the burden of refugees in a fair way. There must also be greater appreciation for the role that frontier nations, such as Greece and Italy, play in protecting the external

border of Europe. Given the prominent role that that European Commission plays following the introduction of the Schengen Governance Package, it has a key role to play in bringing together member states to share the responsibility and reduce the burden on external border-states. However, simplifying the solution to the introduction of quotas seems not to be the answer given the possible backlash in some member states and issues of public perception that may result in even more far right governments coming to power that may not look at the whole European project favorably. Evidently, European policy makers face a delicate balancing act, but if political will was able to bring European nations to agree to a borderless Europe three decades ago, the same will should help overcome many of the current challenges.

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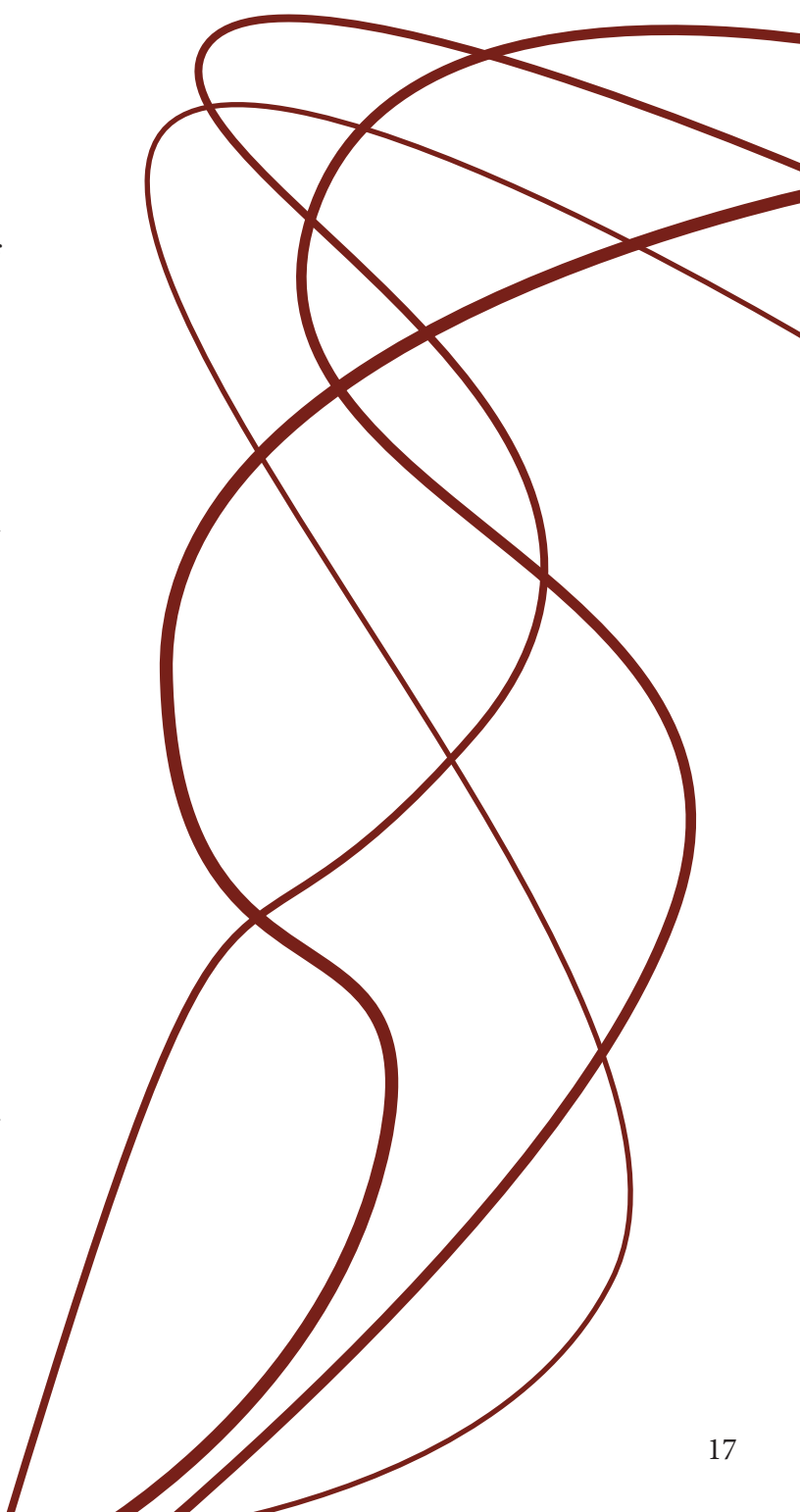
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OMINOUS COMMUNIST FIFTH COLUMNISTS: THE MAKING OF MCCARTHYISM AND THE SECOND RED SCARE

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On March 26, 1947, in a testimony before the House Un-American Activities Committee (HUAC), FBI Director J. Edgar Hoover laid out the prevalent world-view towards American communism. In the testimony, Hoover asserted that, “The Communist movement in the United States... stands for the destruction of our American form of government; it stands for the destruction of American democracy; it stands for the destruction of free enterprise; and it stands for the creation of a ‘Soviet of the United States’ and ultimate world revolution”. Hoover was not alone in having these views. The supposedly unprecedented danger that Communism posed to the American way of life became a mania that percolated throughout the whole society. This paranoia formed the period known as the ‘Second Red Scare’ of late 1940s until the middle 1950s. The Communist ‘witch hunt’ targeted all levels of the United States from the local schoolteacher to the highest reaches of the American government. The drive to root out not just the miniscule number of Soviet spies, but also the much larger Communist Party and its sympathizers, was far from spontaneous. Anti-Communism pervaded much of the American public at this time, spearheaded especially by a loose coalition of politicians, businesses, religious and patriotic orders, and investigation agencies. This undercurrent, combined with unsettling international events, allowed the Second Red Scare to explode into the spotlight. The emergence and perpetuation of the Red Scare was a result of the long-standing anti-Communist sentiment in America taking advantage of the setbacks in the early years of the Cold War.

The Second Red Scare represented the culmination of a decades-long backlash against groups,

people, and ideas that were seen as un-American. It was a reaction to the twentieth century that had – up to that point – been incredibly destabilizing for the United States. At the opening of the century, the nation seemed on the brink of insurrection, with radical leaders like Luigi Galleani leading the Anarchist charge against the American political and economic system. The 1901 assassination of President McKinley was the first in a series of killings and bombings by Anarchists during the period. The 1917 Russian Revolution highlighted the danger that a small cadre of disciplined radicals could pose to the established order, a fact that critics of Anarchism, and later Communism, would not miss. The terrible general strikes and race riots of 1919 seemed to signal, in the minds of many conservative Americans, an attempted Bolshevik coup in the United States. Although the prophesized 1920 May Day Revolution failed to materialize and the Palmer Raids showed themselves to be superfluous, anti-Communism was not significantly set back. In fact, the events of 1919-1920 not only focused public attention on the Communist threat, but also allowed leading anti-Communists to begin to widen the scope of potential ‘subversives’ past the stereotypical ‘bomb-throwing Anarchists’ to other groups and individuals. When the Second Red Scare emerged in the late 1940s, they would be the new targets.

The first of these groups were the country’s labor unions. The general strikes of 1919 hailed an emergence of radical unions in America. The International Workers of the World, formed in 1905, was joined by various Communist-led unions during the 1920s and 30s. The conservative labor community responded by denouncing these organizations. In

1934, American Federation of Labor (AFL) president, William Green, contended that Communism's mission was to coopt labor unions and create "a revolutionary organization to overthrow American economic and political institutions". The public mood and the rank-and-file of the major unions tolerated suspected Communists during the 1930s, but as anti-Communism reemerged after the Second World War, the toleration dried up. In an effort to get out in front of the Communist issue, the AFL and its rival, the Congress of Industrial Organization (CIO) took draconian steps to purge their organizations of alleged Communists. The CIO realigned its traditional radical leftist worldview towards vehemently opposing the Soviets on the world stage and Communists within its own ranks. The Taft-Hartley Act, which had so diminished the power of the unions, was appropriated by them to use against their Communist members. The CIO went further in proving its anti-Communist credentials by ousting several allegedly Communist-led unions from its membership. The story of anti-Communism and American unions serve to show how the tenor of the times forced even the left-leaning segments of the population to become accomplices of the Red Scare furor.

The backlash against American Communists was not restricted to the unions. To complement President Truman's loyalty program, the Attorney General created a list of organizations that were deemed subversive, Communistic, or advocated unconstitutional change of the American political system. The list – expanded from 93 to 197 organizations between 1847 and 1950 – included youth leagues; ethnic and religious groups; civil rights organizations; Socialist, Communist, or Fascist parties; and radical labor unions. J. Edgar Hoover argued that Communists infiltrated hundreds of organizations for "the promotion of Soviet war and peace aims, the exploitation of Negroes in the United States, work among foreign-language, and to secure a favorable viewpoint towards the Communists in domestic, political, social, and economic issues". To those who believed what Hoover was saying, it would have seemed as if a great number of groups were secretly subverting the American way of life. Senator Joseph McCarthy epitomized the feeling in his 1950 Wheeling speech by reminding his audi-

ence that, "we are not dealing with spies who get thirty pieces of silver to steal the blueprints of a new weapon". In effect, the 'War on Communism' was not simply against paid spies from Moscow, but also against the threat from Americans who would attempt to nudge American public opinion and policy to the advantage of Communists and the Soviet Union. The Hollywood blacklist provides an example of how the sliding definition of a threat came to be applied to individuals who were suspected, not necessarily of advocating the overthrow of the American government, but of belonging to the Communist Party or of presumed sister organizations. The Hollywood Ten were famous for refusing to admit or deny belonging to such a group; as a result, they were cited in contempt of Congress and were blacklisted from the film industry. These and other examples show the all-encompassing nature of the Second Red Scare. Traditional opponents of the scare-mongering became willing accomplices in an attempt to shield themselves from charges of Communist sympathies.

The anti-Communist paranoia was often stoked by groups and individuals who had a vested interest in the issue. Some of the most vocal anti-Communists, for example, were Catholics. Soviet persecution of Catholics in Eastern Europe pushed the Church to become bitterly hostile to anyone who seemed sympathetic to the Soviet cause. The American Legion, a veterans group founded in the aftermath of the First World War, was also a persistent foe of American Communism. They sought to inform the public about the Communist menace and to promote patriotism and Americanism as the best defense against subversion. Many organizations took it upon themselves to root out Communists, often as a means to deflect criticism from hardline anti-Communists. Hollywood and labor unions have previously been mentioned, but schools, legal institutions, and the government itself were all fixated on purging themselves of any suspected Communists.

When President Truman vetoed the McCarran Internal Security Bill, he called it "a mockery of the Bill of Rights" and "a long step towards totalitarianism" The veto was overturned by a huge margin. How was it that the President of the United States was not able to prevent the passage of such a reac-

tionary bill? The domestic factors examined above only provide part of the answer. The anti-Communist sentiment and the network of anti-Communist groups and accomplices set the stage for the Second Red Scare, but it alone could not spark the nationwide paranoia of the period. The Cold War developments, and the subsequent security panic was just the spark that was needed.

The first of these events occurred in 1949, along the steppes on modern-day Kazakhstan, with the detonation of RDS-1, the Soviet Union's first atomic bomb. The news of the test sent shockwaves throughout the United States. The American public had been conditioned to view the Soviets as technologically backwards and incapable of producing an atomic weapon until the early or middle 1950s. It was clear that they had received information from 'Atomic Spies' involved in the Manhattan Project. The most prominent spy picked up by United States intelligence services was Julius Rosenberg and his wife, Ethel Rosenberg. The severity of the betrayal was clear. Judge Irving Kaufman, who would hand down the death sentence to the Rosenbergs, stated, "We must realize that we are dealing with a missile of destruction which can wipe out millions of Americans". He further condemned them, stating, "I consider your crime worse than murder". The unprecedented fear of nuclear war – a scenario only possible due to the actions of individuals like the Rosenbergs – raised the stakes of failing to stop Communist infiltration.

Likely the most famous (or infamous) aspect of the Second Red Scare relates to the investigation of Communist influence within the government of the United States. Prior to 1949, there had been occasional investigations and hearings into potential Communist influences within the government, particularly the State Department. The most famous of such cases was that of Alger Hiss, a liberal assistant to the Assistant Secretary of State who was charged for espionage and convicted of perjury. The government investigations would hit their stride following news that China had fallen to the Communist forces of Mao Zedong. The shocking collapse of the Nationalist forces under Chiang Kai-shek opened the government up to scrutiny about harboring Communists; conservative politicians were loath to admit that Chiang's corrupt and inept administration

was responsible for the revolution. The so-called 'China Lobby' attacked the Truman administration for supposedly harboring Communist sympathizers, like John Stewart Service and Owen Lattimore, in the State Department. Indeed, the two men in question had written scathing attacks on Chiang's government while stationed in the Far East during the war. Service was accused of handing sensitive documents concerning Far Eastern policy to the Pro-Communist China journal *Amerasia* but was not convicted. The failure to clamp down on Service proved, in the minds of Joseph McCarthy and his ilk, were 'soft on Communism'. McCarthy used Service's activities to propel himself into the political spotlight, which also put the Truman administration and Democrats on the defensive. These charges forced many liberals unwillingly to join the anti-Communist coalition, in the hopes of not being accused, themselves, of harboring Communist sympathies.

The final ingredient to create the Red Scare mania was the Korean War. The Korean War silenced much of the opposition to the anti-Communist crusade. Typical wartime measures to limit freedom of speech were employed regularly. The Alien Registration Act of 1940, for example, was revived and used against leaders of the Communist Party to great effect. Author of the majority opinion, Chief Justice Fred Vinson, noted that "Certainly an attempt to overthrow the Government by force, even though doomed from the outset...is a sufficient evil for Congress to prevent". He went on to state, "It is the existence of the conspiracy which creates the danger... If the ingredients of the reaction are present, we cannot bind the government to wait until the catalyst is added". The Chief Justice was saying that, in times such as those in which he lived, the threat of violent revolution was enough to warrant repression. He was not alone in his opinion. The wartime fever had infected the whole country, giving the Second Red Scare exactly what it needed to perpetuate itself.

The anti-Communist feeling of twentieth century America, combined with early Cold War developments, allowed for the development and propagation of the fear and paranoia of the Second Red Scare. The legacy of America anti-Communism encompassed a broad mania of radical and subversive

groups. Labor unions and other leftist groups were targeted, forcing them to become complicit in the acts by purging their ranks of alleged Communists. A broad coalition of anti-Communists were instrumental in pressuring organizations to take a tougher stand against the supposed threat. The catalyst for many of the worst abuses came as a result of the ramping up of the Cold War. The detonation of the first Soviet nuclear weapon produced a furor over atomic spies. The Chinese Communist Revolution created a panic regarding Communist infiltration of the State Department specifically, and the government more generally. Finally, the Korean War provided the McCarthyites with the patriotic cover to advocate for a quashing of dissent. The measures that ended up being employed against subversives in the United States may have been largely hysterical, but the mood of the period more than warranted that overreaction.

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IDENTIFYING PERCEIVED LOUDNESS IN AUDIO SIGNALS

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ABSTRACT

In processing audio, it can be helpful to have algorithms that can extract volume and loudness information. One application of this would be finding speech in long intervals of silence. Digital audio files, which contain raw information, may not represent how a human can perceive the sound. For example, high and low frequencies of sound with equal intensities will be perceived as having different levels of loudness. This paper presents a series of processing operations to be performed on sound signals, which attempt to find the loudness of sounds as perceived by a human. Previously used methods of calculating perceived loudness includes looking at the frequency spectrum of sounds [1]. The first operation accounts for the human perception of loudness at different frequencies. The second creates an envelope of the sound signal, while preventing impulses from getting filtered out. These impulses are short bursts of sound such as a gunshot or a handclap. The third operation accounts for the human perception of impulse loudness. The output of this process is an envelope of the original sound signal, which represents how a human would perceive the audio volume. This removes the sinusoidal components in the sound signal and maintains the sound amplitude information, with some other minor adjustments.

INTRODUCTION

In large sound audio files, it can sometimes be desirable to have a computer quickly identify the louder sections of an audio clip for further processing. For example, algorithms that perform speech processing need to identify the periods of silence

in an audio clip, which are of no interest to the algorithm. Similarly, algorithms processing audio recordings of birds chirping may want to identify where in the audio file the chirping actually occurs. A simple naive approach to solve this problem could be to set a threshold on the audio amplitude. This way, any signal with amplitude less than the threshold could be deemed as “silence” and any signal with amplitude greater than the threshold could be deemed as “sound”. The problem with this technique is that it does not consider how humans perceive sound. For example, the human ear is much less sensitive to very high frequency sound [2]. Similarly, short sound impulses are perceived as quieter by humans [2]. On top of this, because sound waves oscillate up and down (like a sine wave), it becomes more difficult to identify the actual peak amplitude of a given sound signal.

This paper presents a signal processing method that attempts to extract the perceived loudness information from an audio signal. This is done by taking the envelope of the audio signal. On top of this, adjustments based on audio frequency and short impulses are made. The resulting signal makes it easy to programmatically identify the loudness of an audio file at any point in time.

METHODOLOGY

To extract the perceived loudness from an audio signal, three steps are performed. Firstly, the frequency components of the signal are modified to reflect what is being perceived by humans. For example, frequencies to which humans are less sensitive are attenuated, and frequencies to which humans are more sensitive are amplified, by amounts described by equal-loudness curves and transfer

functions used by Rimell et al. [3]. Secondly, the envelope of the audio signal is found to eliminate the actual sound vibrations and preserve the amplitude information of the vibrations. Finally, short sound impulses in the audio signal are identified. These impulses are then attenuated based on their duration, according to a human's ability to perceive these impulses as described by Everest [2]. The following subsections discuss the detailed steps used for each operation.

Frequency Adjustment

Given equal sound pressures, different frequencies are perceived with different levels of loudness by humans. In particular, low and high frequencies are attenuated by human perception [2]. A study of this phenomenon led to the creation of a standard set of equal-loudness curves, as discussed in the referenced work [4]. These curves represent the sound pressures required across all frequencies to create sounds with the same perceived loudness.

One of the works in the references identified a transfer function that approximates the filtering effect of the human ear and human perception [3]. This filtering effect corresponds to an equal-loudness curve. The transfer function from the referenced work is applied in this paper in order to perform A-weighting on audio signals that attenuates the high and low sound frequencies.

Signal Envelope

To identify the amplitude of an audio signal, the envelope of the sound signal needs to be identified. The envelope signal traces the maximum peaks of the original signal and removes the oscillatory components. Although there already exist methods to do this, such as the Hilbert Transform Filter [5], a technique is presented here that also preserves the duration of impulses in audio. Doing so allows further processing to be done to attenuate the amplitude of the impulses to better reflect how they are perceived by the human ear.

To obtain the amplitude envelope of the audio signal, the absolute values of the signal are first obtained. After this, a double sliding window is applied to each sample in the input signal. As shown in Figure 1, the sample on which the double window is being applied is shared by each of the half win-

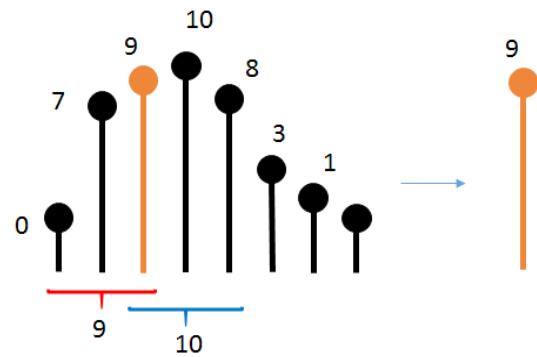


Fig. 1. Double sliding window.

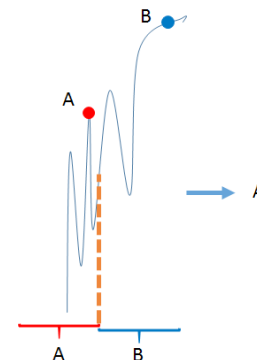


Fig. 2. Double sliding window, removing high frequency.

dows. For each half window, the maximum value is found. Finally, the output sample value is the minimum value of the two half window maxima. In the case of the example, the maximum in the first half window is 9, while the maximum in the second half window is 10. This means that the output sample value is 9.

The double sliding window eliminates higher frequency vibrations by replacing oscillation values with nearby peak values. Figure 2 shows an example of this, where the input signal dips down because of a higher frequency vibration but is replaced with a neighboring maximum value, A, in the output.

This signal filter is able to preserve the width of impulses because this filter will only output a high value when samples from both sub-windows are high. For an impulse, this would only happen with the sliding window is directly centered underneath the impulse. Figure 3 provides an example of this.

The size of the double sliding window deter-

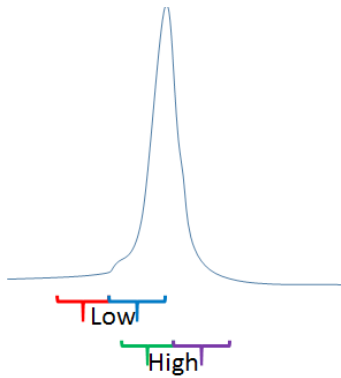


Fig. 3. Impulse double sliding window.

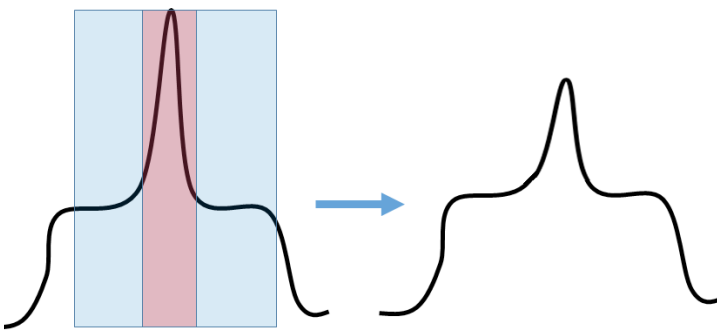


Fig. 4. Impulse correction.

mines the frequencies that will be eliminated in order to obtain the envelope function. Since humans are only able to hear sounds with frequency above 20 Hz [2], the window is selected such that it covers exactly one period of a 20 Hz sine wave. This eliminates all human hearable oscillations and only preserves the envelope of the signal.

Impulse Correction

The human ear is not as sensitive to short impulse sounds as to other sounds. The technique in this subsection provides a way to modify the signal so that short impulses are attenuated to match how they would be perceived. According to a figure in *The Master Handbook of Acoustics*, a 10 ms impulse needs to be roughly 10 dB higher than a 200 ms impulse for humans to perceive them as the same loudness. Moreover, the relationship between impulse duration (in milliseconds) and perceived loudness (in decibels) is roughly linear with respect to the logarithm of the impulse duration up until 200 ms [2]. Using this information, a simple linear

equation can be found that relates the duration of an impulse to the sound pressure increase to maintain equal loudness. This relation is shown in Equation 1.

Equation 1: Sound Pressure to maintain equal loudness

$$P_{increase} \approx \frac{10 (\log t - \log 200)}{(\log 10 - \log 200)}$$

$P_{increase}$ is the increase in sound pressure required to maintain equal perceived loudness in decibels and t is the duration of the impulse in milliseconds. The equation is valid for impulse durations less than 200 ms. Equation 2 shows the conversion between decibels and magnitude.

Equation 2: Pressure increase conversion from dB to gain ratio

$$P_{increase_Mag} \approx 10^{\left(\frac{P_{increase}}{20}\right)}$$

In order to modify the signal, the impulses first need to be identified. Afterwards, for each impulse, the amplitude is scaled down by dividing the original impulse amplitude by $P_{increase_Mag}$.

In order to identify the impulses in the signal, all of the peaks are identified in the signal. A peak in this context is where a sample is greater in value than both of its adjacent samples. Afterwards, for each peak, the area under the surrounding 200 ms is compared to that of an ideal (rectangular) impulse. The ideal impulse rectangle is then gradually shrunk in duration until the area under the signal is close to that of the rectangular impulse. When the area of the signal is within a certain threshold to that of an ideal impulse, the impulse in the signal is then shrunk based on the ratio in Equation 2.

Figure 4 shows an example of this impulse correction. The blue rectangle is the starting 200 ms area around the peak. The width of this rectangle is gradually reduced until it reaches the size of the red rectangle. At this point, the area within both the red rectangle and the signal envelope is greater than a certain proportion of the red rectangle's area. Experimentally, a threshold of 0.4 times the ideal rectangular impulse (red rectangle) area is effective at identifying most of the short sound

spikes in the signal. Finally, the part of the signal overlapped by the red rectangle is scaled using the factor calculated in Equation 2. Equation 3 shows the formula used to calculate the corrected signal value. The corresponding values used in the equation, found in the original signal, can be found in Figure 5.

Equation 3: Impulse Correction Formula

$$Value_{new} = \frac{Value_{current} - \max(Base_R, Base_L)}{P_{increaseMag}} + \max(Base_R, Base_L)$$

Testing the Methodology

In order to test this algorithm, three very different sound clips from the SYDE252 course at the University of Waterloo [6] are used. The first one is a drum sound clip containing many impulses. The second sound clip is that of a robin chirping, which contains high frequency sounds. Lastly, there is a sound clip of a person saying a sentence. The sound signals can be found in Figure 6, Figure 7, and Figure 8 respectively.

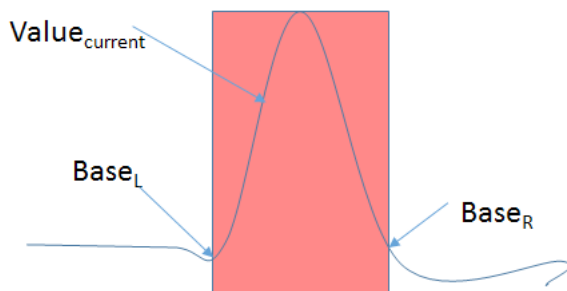


Fig. 5. Impulse correction variables.

RESULTS AND DISCUSSION

The three filtering techniques described in the previous section were applied successively to each signal.

For the drum loop audio signal, Figure 9 shows the frequency adjusted audio signal overlaid on top of the original drum loop signal. As shown, the higher frequency vibrations, which are less audible to the human ear are attenuated to better reflect the human's perception of sound.

In Figure 10, the blue signal shows the envelope of the signal in Figure 9. As shown, in the image, the double sliding window was able to effectively remove all of the higher frequency oscillations and output a signal that roughly represented the amplitude of the input. Finally, the orange signal in Figure 10 shows the output after the impulses have been shrunk accordingly. From the figure, it is possible to see that all of the short sound spikes have been scaled down.

A similar procedure has been done to the other sound clips. The resulting audio amplitude signals are shown in Figure 11 and Figure 12. From

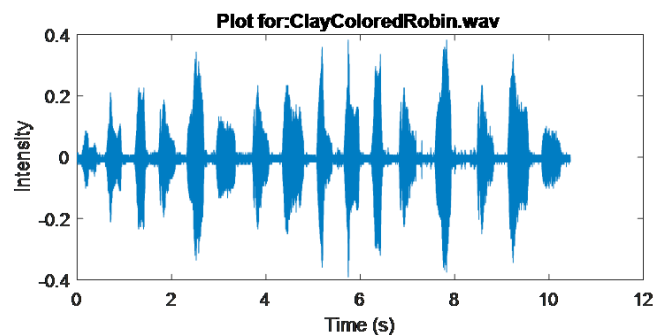


Fig. 7. Robin chirp (audio signal).

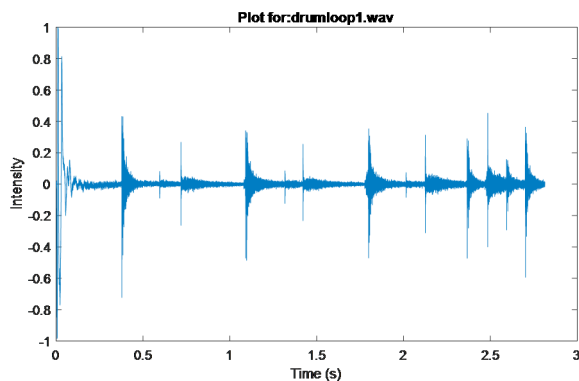


Fig. 6. Drum loop (audio signal).

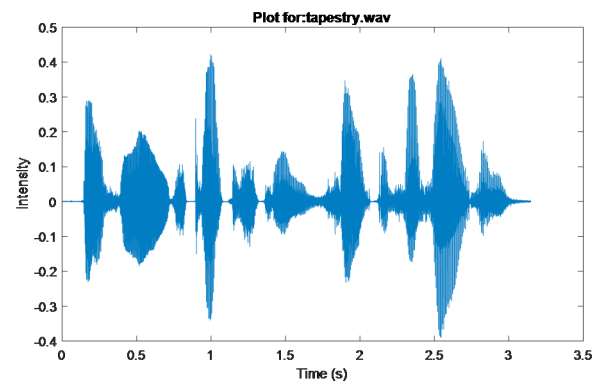


Fig. 8. Person speaking (audio signal).

these two figures, the amplitude of the audio signal at any given point can be easily estimated.

Once the amplitude of the sound file at any given point can be found, a computer algorithm can easily read off an estimate of how loud a sound signal is just by finding the signal's value at a particular point. Moreover, if it is desired to see whether sound amplitude reaches above a certain threshold, a simple thresholding algorithm can be applied to the processed signals.

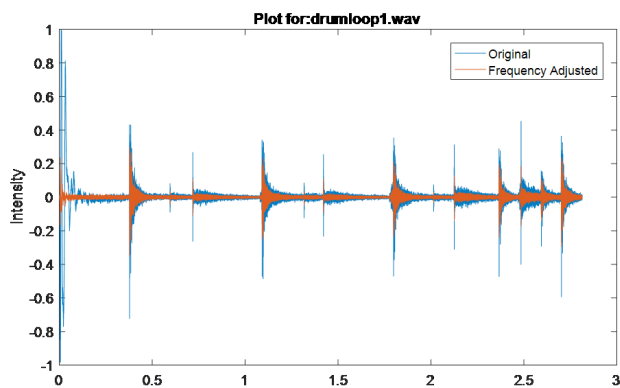


Fig. 9. Drum loop, frequency-adjusted.

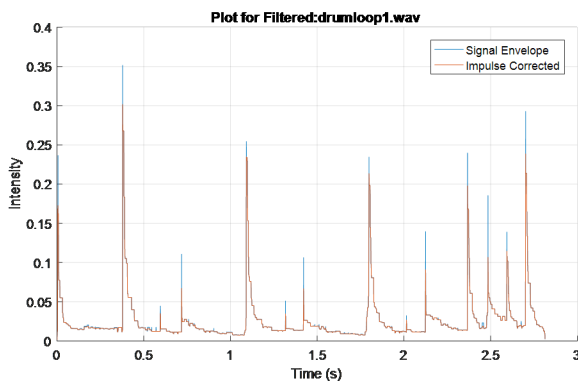


Fig. 10. Drum loop, output signal.

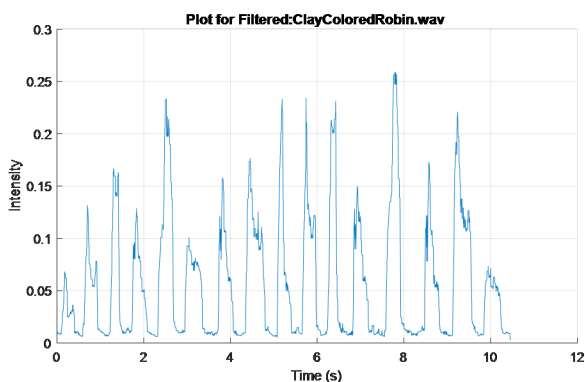


Fig. 11. Robin chirp, output signal.

CONCLUSION AND FUTURE WORK

In conclusion, this paper presents a combination of techniques that can output the amplitude information of an audio signal. On top of this, certain adjustments are made so that the amplitude values better reflect what would be perceived by a human being. The method presented can be used so that a computer can algorithmically identify portions of an audio signal that humans would perceive as louder or quieter.

Although the method presented here does seem to work well for the three audio signals used in the experiment, more rigorous testing of this method should be done in the future.

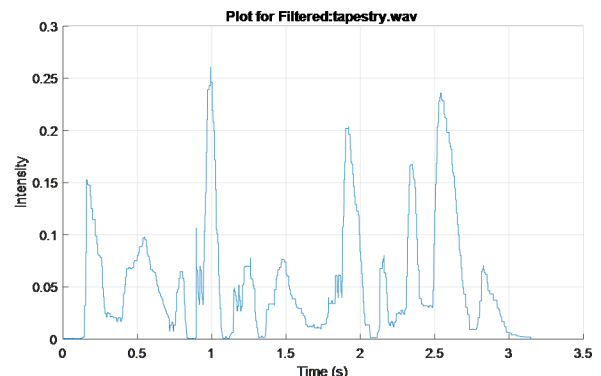


Fig. 12. Person speaking, output signal.

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EXPLORING A NOVEL APPROACH TO STUDY SELF-ESTEEM IN CHILDREN: AN IMPLICIT MODEL

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INTRODUCTION

To look at one's self in the mirror and say, "I like who I am," or, "I am worthwhile," and to truly mean it is not a simple task for most individuals. Yet these subjective evaluations of our-selves – our self-esteem – are incredibly influential on a wide range of outcomes. Past research has shown that self-esteem is related to academic achievement (Marsh, 1990), happiness (Baumeister, Campbell, Krueger, & Vohs, 2005; Taylor & Brown, 1988) and psychological well-being (Kernis, 2003). These findings are especially significant for children, as the development of self-esteem in early childhood may have major implications throughout their course of life. Therefore, extensive research is necessary to begin applying our knowledge of self-esteem development in order to examine specific parental practices and techniques that promote healthy self-esteem in children across different cultures. However, previous research has been based predominantly on the use of explicit measures of self-esteem such as parental report or child self-report (Li-Hua, Li-Zhu, & Fang, 2006; Rosenberg & Pearlin, 1978). This may be an issue as explicit measures of self-esteem for children are limited (Hughes, 1984) and inherently susceptible to response sets such as social desirability (Nosek & Greenwald, 2005). As well, explicit measures potentially paint an incomplete picture with respect to an individual's self-esteem; self-reports may not necessarily mirror an individual's nonconscious or implicit feelings of self-worth (Hofmann, Gawronski, Gschwendner, Le, & Schmitt, 2005). In this paper, I advocate for the use of a non-deliberative implicit model to help mitigate these issues when

studying children's self-esteem. I will provide arguments emphasizing the need for a multifaceted approach with respect to the study and application of self-esteem research in children and to determine specific factors, such as parental style, that encourage its positive development. Implicit measures for children will be outlined to determine their validity and reliability for future research and directions for future research advocating a holistic and multicultural approach to the study of self-esteem will be discussed.

BENEFITS OF STUDYING IMPLICIT SELF-ESTEEM IN CHILDREN

Although there has been extensive research into the development of self-esteem in children, most of these studies have relied on an explicit measure of self-esteem through parents or teachers (Fuchs-Beauchamp, 1996; Hughes & Pugh, 1984) as well as through children's self-report (Hughes, 1984). One potential limitation with this approach is that explicit measures can be affected by response sets such as social desirability (Greenwald, McGhee & Schwartz, 1998) as well as self-enhancement biases (Taylor & Brown, 1988). On the other hand, implicit self-esteem, which is defined as an "automatic and nonconscious evaluation of the self that guides spontaneous reactions to self-relevant stimuli" (Greenwald & Banaji, 2005; Pelham & Hetts, 1999), may be less susceptible to these biases. This is due to the fact that implicit measures of self-esteem reduce the available mental control required to produce the response and mitigate the role of intentional processes (Nosek, Greenwald, & Banaji, 2007). Implicit measures provide an "automatic"

and “non-deliberative” representation of an individual’s attitude and thus, may be a more reliable indicator of their true attitude (Nosek et al., 2007).

Implicit self-esteem has been implicated in various aspects of mental well-being, such as by acting as a buffer against adverse consequences of failure (Greenwald & Farnham, 2000), as well as mediating anxiety in self-relevant interviews (Spalding & Hardin, 1999). Research by Hetts and Pelham (1999) also highlights the importance of implicit self-esteem as it may aid in coping against stigmatization. In light of these potential benefits of positive implicit self-esteem, it is clear that utilizing an implicit model may prove largely beneficial in developmental research, especially in its application to find specific factors, such as specific types of parental style, that promote positive development of self-esteem.

PARENTAL STYLE AND CHILDREN’S SELF-ESTEEM

One domain that has been of particular interest to researchers is the development of children’s self-esteem in relation to parental style. Previous studies have investigated the differential effects of parental rearing styles on self-esteem across an individual’s lifespan and in different cultural contexts (Antonopoulou, Alexopoulos, & Maridaki-Kassotaki, 2012; Furham & Cheng, 2000; Herz & Gullone, 1999). Specific studies have provided empirical evidence that an authoritative parenting approach (Baumrind, 1971) is related to higher self-esteem in childhood (Li-Hua et al., 2006) and adolescence (Milevsky, Schlechter, Netter, & Keehn, 2007). Furthermore, research has provided support for the importance of self-esteem in its relation to individuals’ psychological well-being with respect to both depression (Dumont & Provost, 1999) and happiness (Furnham & Cheng, 2000). However, past research tends to examine parental styles and their relation to the development of self-esteem through a Western-centric lens and may not be generalizable to all cultures. In support of this account, one study found that Brazilian adolescents from indulgent families had comparable social and academic outcomes, as well as greater self-esteem when compared to adolescents of parents that advocated

an authoritative style (Martinez, Garcia, & Yubero, 2007). As well, research into East Asian cultures show that the Chinese have specific concepts embedded in their traditions and language that associates parental love and care with firm governance of the child (Chao, 1994). One implication of this cultural norm is that authoritarian parenting style tends to lead to better outcomes in Chinese households that have adopted these values, in comparison to authoritative parenting.

Although there has been extensive research examining the relationship between parental style and self-esteem, the studies have primarily focused on an explicit form of self-esteem. Less research has been devoted to examining the effects of implicit self-esteem, especially in children, despite its potential significance. Indeed, Jordan, Spencer, Zanna, Hoshino-Browne, and Correll (2003) highlighted the importance of taking a holistic approach in studying self-esteem to develop a more accurate picture of an individual’s personality traits. Specifically, they found that a combination of high explicit self-esteem and low implicit self-esteem is related to greater defensiveness and higher levels of narcissism in undergraduate students. The aforementioned example provides insight into the necessity and utility in advancing an implicit model to study self-esteem. This gap in research is especially prominent and concerning in the developmental field as the development of self-esteem may begin as early as three years of age (Li-Hua et al., 2006). However, in order to begin investigating implicit self-esteem in children, we must first consider the plausibility of measuring the construct through examining previous validated implicit measures of self-esteem.

IMPLICIT MEASURES OF SELF-ESTEEM IN CHILDREN

The vast majority of methodologies dedicated to measuring implicit self-esteem has focused on catering to the adult population (Greenwald & Banaji, 1995; Greenwald & Farnham, 2000). However, there have been recent advances in the development of implicit measures for children. For example, Cvencek, Greenwald, and Meltzoff (2011) successfully adapted the original Implicit Associa-

tion Test (IAT) by Greenwald et al. (1998) to be accessible for children as young as 4-years-old. They found that this child-friendly version of the IAT was sensitive to evaluative preference for flowers over insects. In addition, the study found that implicit preferences for flowers were stronger in girls than in boys, as demonstrated in a previous study by Baron and Banaji (2006), thus providing greater convergent validity. Furthermore, a recent study by Cvencek, Greenwald, and Meltzoff (2016) used this Preschool Implicit Association Test (PSIAT) to examine implicit self-esteem in young children. The self-esteem PSIAT is a double-categorization task that combines a concept classification (me vs. not-me) and an attribute classification (good vs. bad), with these dimensions represented as pictures and words (Cvencek et al., 2011). This task provides a measure of implicit self-esteem by comparing response latency to infer the strength of association between two dimensions. Thus, children who have higher positive implicit self-esteem will respond more quickly when the attribute classification is congruent (good) compared to when the attribute is incongruent (bad).

GENERAL CONCLUSIONS AND FUTURE DIRECTIONS

There clearly exists great value in examining self-esteem in children due to the various outcomes correlated with the construct, such as its relationship with mental health (Lloyd & Miller, 1997) and life satisfaction (Milevsky et al., 2007). Past research has also shown that various constructs are better predicted by measures of implicit self-esteem, including persistence in failure and coping against stigmatization (Hetts & Pelham, 1999; Greenwald & Farnham, 2000). Thus, implicit self-esteem may tap into important constructs that are less associated with explicit self-esteem. As well, studies have shown that incongruence in implicit and explicit self-esteem is linked to narcissism and greater defensiveness in adolescence (Jordan et al., 2003). This suggests the importance of taking an implicit model into consideration in order to provide a more complete and accurate account of a child's self-esteem. Further research using this model to examine the factors that impact self-es-

teem will be useful in determining the ideal conditions for a child's growth. Thus, it will be necessary to focus on further developing reliable and valid implicit measures of self-esteem that are accessible for young children. In addition, specific parental practices may have differential effects on self-esteem development depending on the values and attitudes of an individual's culture (Herz & Gullone, 1999; Wang & Ollendick, 2001). Thus, future research may also benefit from cross-cultural studies to determine specific parental styles that are associated with the healthy development of implicit and explicit self-esteem in young children within different cultural milieus.

Although a major part of this paper is dedicated to the exploration of potential benefits and possibilities of using an implicit model to study children's self-esteem, it is important to recognize that future research will benefit most from examining implicit self-esteem and explicit self-esteem in tandem. Indeed, research has shown that it is the congruence of self-esteem in both domains that is essential when considering future outcomes (Jordan et al., 2003; Zeigler-Hill, 2006). Through employing these models together, we can begin to create a more holistic and accurate picture of the development of self-esteem in children. In doing so, we can extend and apply these findings to determine specific parental practices and environmental factors that foster positive self-esteem, both explicitly and implicitly.

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HIGH RESOLUTION MULTI-GRATING SPECTROMETER CONTROLLED BY AN ARDUINO

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Abstract—We present the design for a high resolution triple-grating Czerny-Turner spectrometer for visible and telecom wavelengths, together with results of optical simulations using ZEMAX. Results from the simulations show that one of the most important factors affecting spectral resolution is the focal length of mirrors. Increasing the focal length allows for a greater degree of spatial dispersion of light diffracted from the gratings and also reduces optical aberrations. Radiation of wavelengths around 1550 nm are shown to have very noticeable aberrations in certain designs, evident by a large degree of smudging. Using parabolic mirrors instead of spherical mirrors is demonstrated to have a negligible effect when compared with increasing focal length. The optical simulations and preliminary testing of mechanical components show that it is possible to build a cost effective high resolution Czerny-Turner spectrometer using off the shelf components.

Index Terms— optical spectrometer, Arduino

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I. INTRODUCTION

Optical spectrometry is a process of analyzing the spectrum of light. It has a broad range of applications in areas such as astronomy, chemistry, and photonics. For example, Raman spectrometry may be used to identify the presence of certain molecules in an unknown sample, and Rayleigh scattering spectroscopy may be used to investigate the properties of an individual single walled carbon nanotube [1][2]. High-resolution spectroscopy capable of resolving spectral features spaced by less than ~10pm is in particular extremely useful for characterizing the spectral properties of solid state quantum emitters, such as self-assembled quantum dots, and semiconductor micro-cavities and photonic-crystal nano-cavities with high Q-factors[3][4].

Here we present the design for a high-resolution Czerny-Turner spectrometer with a focal length as long as 1.5m and three diffraction gratings[5]. While such spectrometers are currently available on the market, they are manufactured in very small volumes, which results in prices exceeding \$100k.

A spectrometer generally consists of a monochromator, which separates the wavelengths of the incident light into different propagation

directions, and of a calibrated one- or two-dimensional photodetector, that detects the relative intensities of light at each wavelength. The monochromator most often utilizes a diffraction grating with adjustable tilt, while the detector is usually a high-sensitivity CCD or CMOS camera for visible light spectrometers and InGaAs diode array for telecom wavelengths.

In a Czerny-Turner monochromator/spectrometer, the input light is focused through a narrow slit, then collimated by a concave mirror with a focal length f , after which it propagates for a distance f where it hits a diffraction grating. Here, light of different wavelengths is reflected under different angles and, after traveling for a distance f , it is refocused onto the detector with another concave mirror with focal length f .

Our spectrometer was not fully built since many critical optical components had lead times of several months and would not arrive while Karl was still present at the University of Waterloo. However, thorough optical simulations predicting the capabilities of the instrument were performed using ZEMAX. Additionally, a prototype of a two-axial rotating turret allowing automated swap between the deployed diffraction gratings, which was called the TRISPEC, was built and is reported here.

II. Mechanical Design

Mechanical devices such as the TRISPEC, camera holder, mirror holders for 4"-diameter concave mirrors with 50cm focal length, and periscope were custom machined.

The acronym TRISPEC comes from TRIPLE Turret SPECTrometer, and refers to the target design feature that will allow the user to switch between active diffraction gratings. The ability to select which grating is used is important since each grating has a different number of grooves/mm, resulting in different degrees of spatial dispersion of light. Therefore, the bandwidth of light which falls on the detector can be controlled by changing the diffraction grating. This allows the user to be able to select between examining a broad spectrum of light, and progressively select narrower bands of light for more accurate inspection of a particular

part of the spectrum.

The simplest design for a triple turret would be to have, for example, one diffraction grating positioned on each of three faces of a triangle and this is in fact used in some of the commercially available spectrometers, such as Acton SP-2750 from Princeton Instruments. Switching a grating is then be a matter of rotating the triangle by 120° . A problem with this design, however, is that any further angular adjustment (to focus in on a spectral region) would have an axis of rotation which is not about the face of the grating. This causes the grating to partially move out of the incident light beam for more extreme tilt angles, which in turn limits the efficiency and wavelength range of the grating.

The TRISPEC design presented here solves this problem by using two axes of rotation. One is for selecting gratings and the other is for fine angular adjustments of the selected grating. A picture and schematic of the TRISPEC are shown in figures 1 and 2. The Parker rotation stage, Kohzu rotation stage, servo motors, and motor control were purchased online. All other materials were custom machined using 6061 aluminum in the student machine shop at the University of Waterloo. The mode of operation of the TRISPEC is as follows. For fine angular adjustments of a chosen grating the Parker stage is controlled. This is done with an STM-200 Stepper Motor, which provides more torque but also requires more current than the NEMA-17. To swap gratings, the Kohzu stage is controlled with the NEMA-17 motor. Both motors are controlled by an Arduino Uno and an Adafruit Motor shield. The motor shield is used since the amount of current outputted by the Arduino is not enough to power the motors. Connecting an external DC power supply to the motor shield permits higher power control of the servo motors, as well as control with useful waveforms resulting in microstepping and double coil steps. Using the Motorshield with 1.2 A and 8V is enough to operate the TRISPEC. How the TRISPEC fits in to the entire design of the spectrometer can be seen in Fig. 8.

Another important mechanical part of the spectrometer is the Periscope. In many optics labs, the beam height above optics table is kept at ~ 10 cm, as this provides a good compromise between mechanical stability of the beam steering

components and convenience for manual alignment. However, given the large gratings dictated by the long-focal length of the spectrometer and the use of two rotation stages for the grating turret, the resulting optical axis of the instrument is at roughly 17 cm. Therefore, a device is needed to raise the input beam from the optics table. The design for the Periscope is shown in figure 3. A parabolic mirror is chosen over a plane mirror so that the periscope may be used to raise the optical axis as well as focus the input light with minimized chromatic and spherical aberration. Adjustment rods and an XY adjuster are used since they allow for fine positioning of the parabolic mirror so that light very precisely passes through the entrance slits of the spectrometer.

III. ZEMAX SIMULATIONS

In addition to prototyping several devices necessary to construct the spectrometer, thorough simulations using Zemax Optic Studio were performed to assess the effectiveness of various design decisions. Decisions include choosing parabolic or spherical mirrors, the number of grooves/mm of a diffraction grating, the focal length of mirrors, and the geometry of the components (i.e., the spacing between mirrors and TRISPEC, entrance slit and mirrors, etc).

Figures 4-7 summarize the results from the ZEMAX simulations. Figures 4 and 5 were generated using 75 mm diameter, 500 mm focal length silver coated spherical mirrors, a 1" diameter 30 mm focal length achromatic doublet, and a 4 mm initial collimated waist of light. The spectrometer was designed in sequential mode in ZEMAX. This allows for fast and precise positioning of optical elements. However, only one wavelength of light may be analyzed at a time in sequential mode, so the whole design was converted to non-sequential mode for multi-wavelength analysis. In non-sequential mode, the spectral resolution can be more effectively studied since comparing two wavelengths side by side allows one to see the effects of optical aberrations and dispersion due to different gratings more clearly. Figures 5 and 7 show graphically what the signal processing software to determine intensity of a certain wavelength would do. The graphs show the sum of the irradiance along a column of pixels. This is useful since in practice wavelength is determined

by which column of pixels light is incident upon. If the two blue spikes are clearly spatially separated, then that is an indication that there exists distinct spectral resolution between the two wavelengths. How symmetrical the two peaks are indicate to what extent optical aberrations are present. The simulations show that a high degree of smudging results from using long wavelength light (~1550 nm wavelength) with diffraction gratings of 1200 grooves/mm or higher. Intuitively, one might expect the greater amount of spatial dispersion resulting at longer wavelengths to positively contribute more to spectral resolution than any negative side effects such as aberrations would. However, the increase in full width 1/10th maximum cancels out the positive effects that greater dispersion would have on spectral resolution.

Full width 1/10th maximum is a measure of how horizontally concentrated light energy is on the detector. It is the spatial distance of the irradiance going from 10% of its maximal value, to its maximal value, and back down to 10% of its maximal value along a horizontal axis. The full width 1/10th maximum is relatively large for 1550 nm wavelength light and a 1200 grooves/mm grating. Therefore, this combination of wavelength and gratings should be avoided. An important conclusion from these simulations is that full width 1/10 th maximum is mainly a function of wavelength and not number of lines/mm of the diffraction grating. For example, the full width 1/10th maximum does not change significantly when using either 1200 or 1800 lines/mm. However, prohibitively large full width 1/10th maximum occurs when using ~1500 nm light. One might expect that with a higher rules/mm diffraction grating more aberrations (such as smudging) would occur since light is dispersed at greater angles. This effect is noticeable but is not nearly as dominant as the effects of wavelength are. Figures 6 and 7 show the effects of focal length on spectral resolution. Clearly, with greater focal length there is more distinct separation of wavelengths. All of the figures show light of 852 and 852.01 nm wavelength. Figure 7 shows that with greater focal length asymmetries in the light hitting the detector are reduced. This is because a smaller tilt of the diffraction grating is needed with higher focal lengths. Less tilt means the light is better able to remain collimated. Figures 6 and 7 also compare the effects of using

a parabolic as opposed to spherical mirror. The reduction of spherical aberrations resulting from using parabolic mirrors is negligible, since greater focal lengths have a much more dominant effect in improving spectral resolution.

IV. SUMMARY AND CONCLUSION

A high spectral resolution spectrometer was designed and several main components of it were prototyped. Complete construction of the spectrometer was not possible since critical optical components would not arrive in time. However, thorough ZEMAX simulations were performed for the high resolution spectrometer as well as multiple other configurations. The ZEMAX simulations show that spectral resolution is directly proportional to focal length. Additionally, optical aberrations are reduced with shorter wavelengths of light (850 nm vs 1550 nm). One part of the spectrometer which was built is the TRISPEC. This device allows the user to select one of three diffraction gratings to be active, as well as finely adjust the angular position of the selected grating about the face of the grating. This device is controlled by two servo motors, an Arduino Uno, and an Adafruit motor shield. Looking forward, decisions must be made as to whether a composite grating system as opposed to a single grating on each face of the TRISPEC will be used. This decision would affect how the TRISPEC is built. The presented model was built to allow a composite grating to be attached. This is so that off the shelf gratings can be used and also to make the design more affordable. In order to build a spectrometer with the highest spectral resolution, long focal lengths such as 152 cm (60") should be used. This would also reduce optical aberrations. Ideally, parabolic mirrors would also be used, but the effects of focal length are much more dominant than the type of curvature. With these design decisions in mind, a cost efficient spectrometer which minimizes aberrations and provides high spectral resolution can be built.

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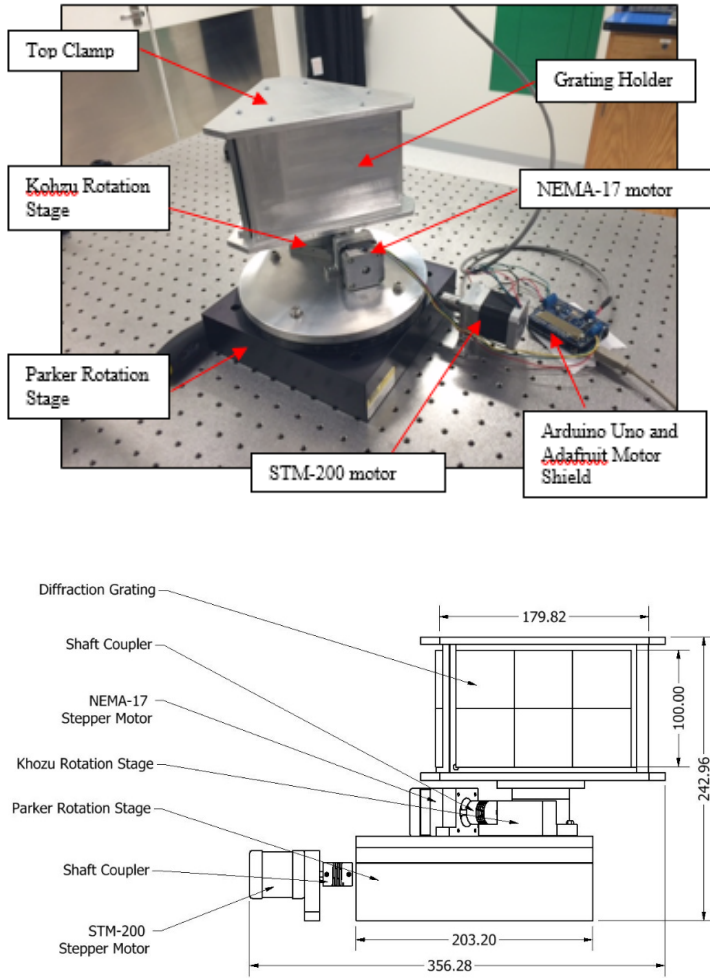


Fig. 1. TRISPEC connected to an Arduino control unit. Diffraction gratings which would be inserted on the device are not shown.

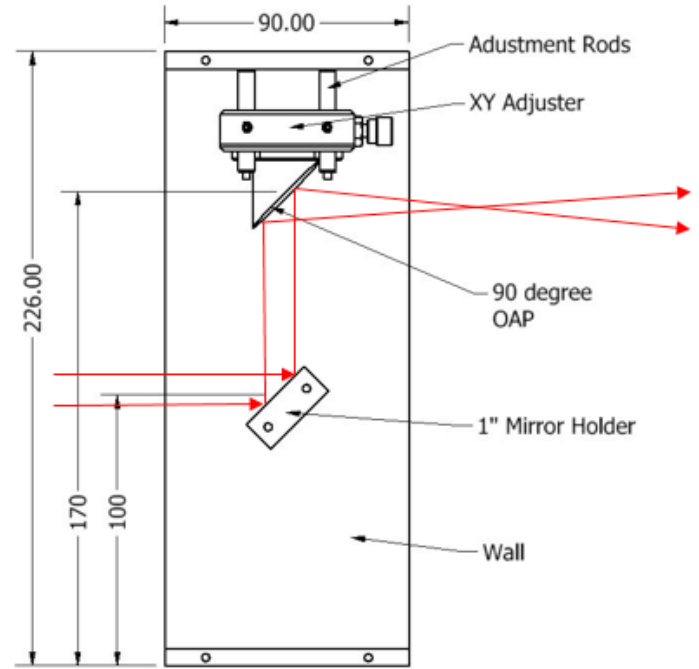


Fig. 3. A drawing of the periscope. Units are mm and the red lines indicate the path of light.

Fig. 2. A drawing of TRISPEC generated in Inventor. All units are mm.

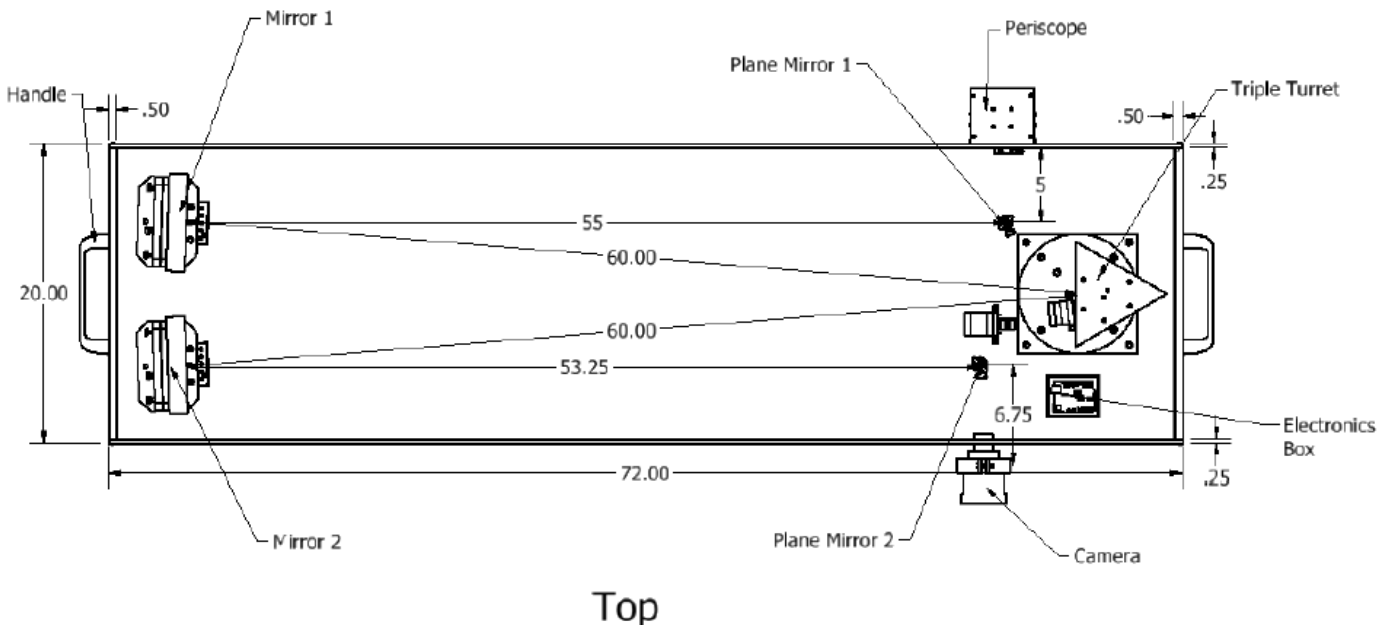
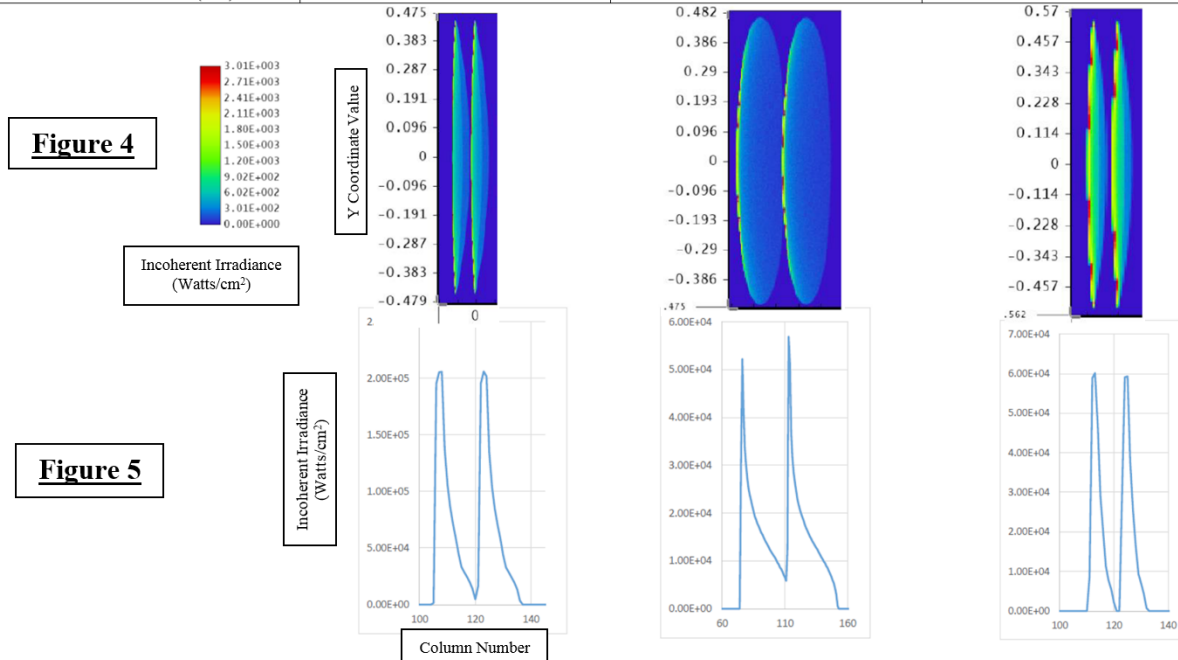
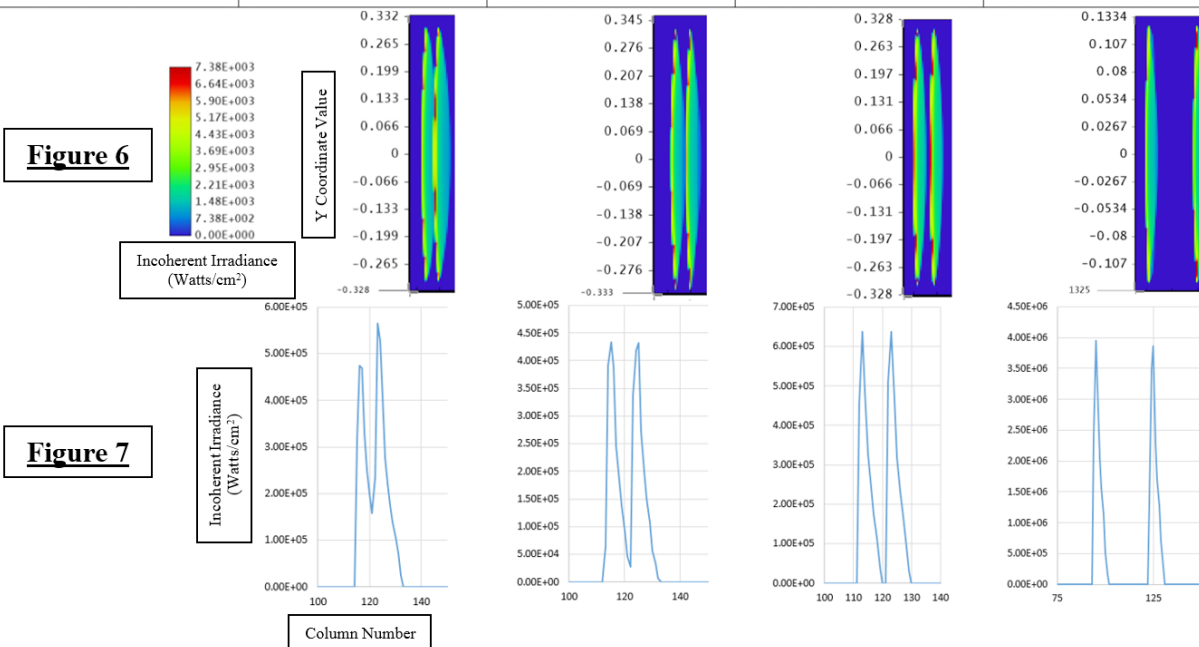


Fig. 8. A top view of the entire spectrometer. All units are inches.

Focal Length (cm)	50	50	50
λ_1 (nm)	852	1550	852
λ_2 (nm)	852.08	1550.04	852.05
Grating (lines/mm)	1200	1200	1800
Full Width 1/10 th Max (μm)	34.8	287	38.6



Focal Length (cm)	91	114	122	152
λ_1, λ_2 (nm)	852, 852.01	852, 852.01	852, 852.01	852, 852.01
Mirror Type	Parabolic	Spherical	Parabolic	Spherical
Full Width 1/10 th Max	37	42	46.8	52.5
Distance Between Peaks	31	35	39.7	46



DISSECTING TURKEY'S "HIDDEN WAR": A DISCUSSION OF TURKEY'S CONFLICT WITH ITS KURDISH MINORITY AND THE SECURITISATION MEASURES SURROUNDING VIOLENCE IN NORTHERN SYRIA AND SOUTHERN TURKEY

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Turkey is in the midst of a little-publicised conflict with its ethnic Kurdish population in the southeast of the country. The Kurds in the east have long been repressed by the Turkish government, as they do not share an identity with the Turkish majority peoples, and as such have waged several conflicts against the Turkish government for many decades. The Turkish government has long fought both a military and propaganda war against the Kurds, with the major condemnation of the Kurds coming from the official labelling of the major Kurdish militant faction as a "terrorist" organisation. As a result, and due to Turkey's role as a major strategic partner within the North Atlantic Treaty Organisation and a strong partner of the European Union, Ankara's allies also consider some Kurdish militant factions as terrorists, posing a major barrier to reconcile the conflicting forces. Often, the Turkish military, which has tremendous capability and recruitment capacity, have launched large-scale battles against Kurdish forces, who are often under-equipped and wage guerrilla warfare against a highly-skilled and organised force.

In light of the current conflict, which began in mid-2015, the Turkish government securitised the conflict as a matter of concern – but only in a domestic setting. The Turkish government urged its allies (namely, NATO and the EU countries) not to interfere in the conflict – whether it be politically or economically, Ankara has assured that it is handling the conflict. This poses problems for Ankara's allies, as the Kurds in the Middle East have proven effective non-state allies in the current conflict against the Islamic State of Iraq and the Levant (henceforth known as Daesh).

This paper poses the question: why has the Turkish government domestically securitised the current Kurdish conflict, while asking its allies not to interfere, thus desecuritising the issue internationally? In answering this question, several steps will be taken to ensure an accurate a portrayal of the conflict can be given. First, a brief overview of the Kurdish conflict will give the reader an historical basis for the context. Second, the current conflict's history will be described concisely due to the complexity and the recent nature of the matter. From this point forward, academic sources cease to be an effective research tool. The conflict is indeed very recent, and relatively little has been published on the subject. As such, primary sources and investigative journalism will be used for a large portion of this essay. Further will this essay discuss the factors leading to the Turkish government's decision to securitise the conflict domestically, and the factors leading it to request its allies not interfere. In conjunction with this, the essay will discuss why Ankara's allies have indeed not commented on the issue, and what factors may contribute to their need to keep Turkey as a strong and placated ally. This essay hypothesises that the Turkish government has securitised the Kurdish conflict domestically by claiming the Kurdish Worker's Party militant group (PKK) are terrorists and threaten Turkish territory, national unity, and domestic security interests; simultaneously, the Turkish government has desecuritisised the conflict abroad by requesting its allies respect the autonomy of Turkey to monopolise violence on its territory and prioritise other regional issues involving Turkey.

The Kurds are an ancient ethnic group spread

across Turkey, Iran, Iraq, and Syria. They were not recognised as a distinct group by the Ottomans, and this lack of designation has carried into the secular Turkish Republic. The Kurds are ethnically and linguistically different from the Turks, but legally have had their identity forcibly removed – there is no provision in Turkish law for different ethnicities, all citizens are considered Turks. This is the baseline for the division in Turkey between Kurds and Turks, but the origins of the Turkish-Kurdish conflict are deeper. In 1924, the new Turkish Republic abolished the Kurdish caliphate system, which allowed for some autonomy of the Kurds in their territories. As a result, combined with the Treaty of Lausanne that guaranteed the territory of modern Turkey as it is today, this angered the Kurds, who launched successive revolts in 1925 and 1927. A third rebellion in 1936 resulted in the crushing defeat of the Kurdish forces, and the banning of non-Turkish nationality – effectively banning Kurdish-ness.

The origins of the current conflict lie in the creation of the nationalist and socialist Kurdish Workers Party (PKK) in 1978. Headed by Abdullah Ocalan, the party provided a platform for Kurds to air their grievances against the government, namely calling for language and cultural expression in their territories. These calls for expression and eventually autonomy fell on deaf ears, and in 1984, the PKK launched an insurgency against the Turkish state. This conflict ended in 2000, with many thousands of people dead and villages destroyed. However, the major turning point in the conflict and context for the current conflict comes from 1998, when Ocalan was forced to flee from Syria (his long time hideout) to Italy. In Europe, he was rejected asylum and entry on terrorism charges, and was arrested in Kenya years later. From prison, Ocalan called for Kurdish unity, and for Kurdish fighters to leave Turkey. This call for unity led to the creation of Kurdish political parties, and Kurdish engagement with the Turkish state. In 2008, remnants of the PKK formed the Peace and Democracy Party, and in 2009 the Erdoğan government allowed for Kurdish broadcasting rights, amnesty for PKK fighters, and the teaching of Kurdish in schools. However, the stigma around the PKK and the Kurds as terrorists remains, despite the political advances of Kurdish political parties.

The current conflict is another flare-up of tensions, but additional factors in the Middle East region led to the conflict. In 2015, the Kurdish People's Democratic Party won a large enough share in parliamentary elections to force president Erdoğan to form a coalition. A short time later, the terrorist group Daesh bombed a Kurdish town, killing nearly 30 civilians. PKK leader Ocalan accused the Turkish military of not doing enough to prevent the attack, seemingly as the attack affected Kurds, not Turks. Following this attack, a reportedly Daesh-initiated suicide bomb at a political rally in Ankara killed over 100 people – and the Turkish government blamed the attack on PKK terrorists, despite the attendance of pro-Kurdish protesters. This led to the breakdown of a Turkish-Kurdish ceasefire, and combat operations in Turkey's east began once more.

In the first two months of 2016, more than 140 Turkish police officers and soldiers died, and as of March 2016, nearly 350 000 civilians have been displaced within the Kurdish regions. Turkish army vehicles and armoured vehicles are currently laying siege to Kurdish towns and imposing curfews in Kurdish territories. For the Turkish military, “curfew” is more related to encirclement and the total siege by armoured vehicles of a town rather than imposing timed curfews on civilians. This is, however, not an equal conflict. Troop numbers are unavailable for either side in this conflict, but the Turkish army is roughly 700 000 strong overall. However, discrepancies appear when hardware and training are discussed. Nearly 470 000 Turkish troops are conscripts, and as a whole, the Turkish land forces lack more sophisticated intelligence technology to take on the industrious Kurds. The Kurds, meanwhile, have gained access to new weapons previously unavailable, such as shoulder-fired missiles allegedly used to neutralise a Turkish military helicopter. This asymmetrical conflict is taking a toll on Turkey at a time when its public resources are stretched thinly by other conflicts.

There are other factors at work in the Middle East that have contributed to the rise of Turkish-Kurdish tensions and conflict. The Arab Spring revolutions of December 2010 and January 2011 greatly destabilised the entire Middle East and North Africa (MENA) region, and nowhere more than in Syria. Syria has been locked in a civil war

since 2011, and many millions of Syrians have been internally displaced as well as forced to flee Syria's territory. Turkey has absorbed some 2.73 million refugees from Syria, and is attempting to control its porous borders both to its south and to its west, with Europe. Simultaneously, Turkey has agreed to support the US in fighting Daesh in Syria. This support, in late July 2015, has coincided with the start date of the Turkish initiating strikes against Kurdish militants. This creates a problem for Turkey and the US, as the US is working closely with Kurdish groups in Syria to help combat Daesh. Some Kurdish troops are originally from Turkey and Iraq, and having an American ally launch airstrikes against their homelands is deeply unsettling. Turkey is even launching airstrikes against PKK and Kurdish positions in Iraqi Kurdistan. The Turkish government has stated that they will not tolerate a new Kurdish state on their Syrian border, and this is the reason for the strikes, but one must not forget the labeling of the PKK as terrorists as a potential reason for Ankara to attack the Kurds.

To formally discuss the issue of the Kurdish "question" in security terms, this essay will begin to discuss how the Turkish government has securitised the perceived threats, and to whom. The Turkish government initially securitised the issue when they designated the PKK as a terrorist organisation. This designation was strengthened in 2002, when the US, EU, and UK governments added the PKK to their terrorism watch lists. Immediately, the issue was classified as disruptive militancy, and thus warranted military measures to combat the Kurds. The question of why the Turkish government opposes Kurdish nationalism or advancement in any shape or form is simply answered as: Turkey values territorial integrity and stability above all else. President Erdoğan in particular, favours a stable state with all citizens working together for mutual benefit. However, the Kurds have never shared in this vision, as they have clamoured for an independent Kurdish state, and have always fought against the Turkish state. This places the Kurds and their political and militant organisations firmly in the "terrorist" category for the Turks. A clear statement to support this is by president Erdoğan himself, quoted as, "My people don't want to see those supported by the separatist terrorist organization

in parliament," in reference to a recent vote to lift political immunity from Kurdish political parties in parliament in light of the violence, which passed into law. The view that the Kurds are terrorists is clearly outlined by the Turkish government, which has responded to the Kurdish conflict as it felt necessary. Immediately, one can also see, in Erdoğan's comment, the use of a "we" followed by an implicit "they." The "we" is to refer to Turks, or those who are not Kurds, whilst the "they" is to refer to those who do identify as Kurds. This method of othering is not meant to dehumanise the Kurds; rather, it is to securitise the conflict even further. As nationality beyond Turkish-ness is outlawed, anyone in opposition to this can be perceived as a threat to Turkish society and state.

The Turkish government has declared the Kurdish PKK terrorists, and have used this designation both to convince their allies of the PKK's terrorist-hood as well as to quell this perceived threat – but this warrants the question, "What have the PKK done to receive this designation?" Following this question is where this essay will examine, in conjunction with the Turkish government's securitisation of the Kurdish conflict, the concept of "one [person's] terrorist is another [person's] freedom fighter." The PKK have used tactics, often learnt from other organisations labelled as terrorists, that warrant the terrorist label. For example, in the current conflict, PKK soldiers (or militants – either term carries a certain unavoidable politics) have been seen to use improvised explosive devices, similar to those used in Iraq by al-Qaeda, which has become Daesh. It is primarily the use of tactics that differentiate the Kurds and the PKK from other rebel groups. However, one must question whether the term "terrorist" is a term of convenience for the Turkish government. Certainly, the PKK has received training from terror organisations such as al-Qaeda, but according to the Atlantic Council, the use of well-trained snipers has been heavily written about in Turkish media. These snipers are reportedly veterans from fighting in northern Syria for Rojava.

Numerous other tactics typical of insurgencies have been employed by the PKK in eastern Turkey, including civilian bomb attacks and hostage taking of Turkish soldiers in the past. The case

for making the PKK a terrorist organisation is also legally described. The US State Department, in its definition of a foreign terrorist organisation, clearly states in criterion 3: “The organization’s terrorist activity or terrorism must threaten the security of U.S. nationals or the national security (national defense, foreign relations, or the economic interests) of the United States.” This description clearly marks the PKK as a terrorist organisation for the United States – the PKK threatens the territorial security of an American ally – and if Turkey were to apply this domestically, then the PKK would also fit as a terrorist organisation. One possible explanation for the turn to traditional extremist or terrorist tactics by the PKK could be the realisation that traditional military tactics would never work against a formal military force. For the relatively under-equipped PKK, the Turkish military is still a formidable force. This statement may be in defence of the “freedom fighter” term for the PKK, but regardless of position taken, the PKK has used extreme tactics to fight a war against a superior military force.

Erdoğan has made several speeches regarding the Kurdish conflict, comments which may show that he stands to gain from attacking the Kurds. Before the November 2015 elections, Erdoğan stated that the PKK and the Kurds were the number one threat to Turkey at that time. His comments and securitisation were successful, as the public did indeed reference the Kurds as the most pressing threat, and Erdoğan was elected as president again. From the Kurdish perspective, some Kurdish politicians believe that Erdoğan has used an agreement with the US to fight Daesh as a reason to fight the Kurds instead. This follows that Erdoğan and Ankara fear the territorial gains made by Kurds in Syria, and fear the existence of both Rojava and Iraqi Kurdistan.

In summary of the above arguments, the Turkish government securitised the Kurdish conflict and the PKK by declaring these actors as threats to several aspects of Turkey. The Turkish government declared the PKK and the Kurds a threat to national unity, as non-Turkish nationality is outlawed, yet the Kurds are identifying as a separate ethnic group. The Kurds are perceived as a threat to Turkish territory as defined by the Lausanne treaty, and therefore must be stopped from accomplish-

ing their territorial ambitions. Finally, the Turkish government perceives the Kurds to be terrorists, as they have and do employ terrorist tactics, which were learnt from other terrorist organisations in the region. These tactics have been used to capture and kill Turkish soldiers and civilians, and therefore warrant the terrorist designation. These three arguments form the core of the Turkish government’s claim to securitise the Kurdish conflict, and they have done so successfully. The next section of this essay will discuss Ankara’s attempt to persuade its allies not to become involved in the Kurdish conflict – desecuritising the issue – and the responses of its allies.

Two months after the beginning of violence between the Turkish government and the PKK, president Erdoğan requested that Turkey’s allies, notably the US and NATO countries, refrain from commenting and interfering in its conflict with the Kurds. This desecuritisation of Turkey’s conflict with the Kurds is interesting to discuss, as desecuritisation is largely a vague topic and can take numerous forms. However, desecuritisation can be seen as akin to depoliticisation:

“the analyst in making an evaluation of a particular securitisation, must always determine the nature of the security relations in relation to the alternative - politicisation - and determine whether or not the securitisation achieved a better overall policy than the politicisation could have done. To reiterate, this evaluation of positive/negative does not result from the analyst’s personal preferences, but rather must follow a rigorous analytical and practical evaluation of what kind of security best addresses insecurity.”

As this is an interpretation of what desecuritisation can mean, Turkey’s move to “play down” the issue of the Kurdish conflict to its neighbours is but one example of numerous desecuritisation attempts in different conflicts and issues in different spaces and times. However, the Turkish case is significant, because it entails a government engaged in a war that it has already securitised domestically – but is requesting outsiders not interfere. It is different, in that Turkey never securitised the issue to a non-domestic audience prior to its desecuritisation. It has become a dichotomy of pursuing a threat at

home, but abroad convincing other national actors that the Kurdish conflict is not an issue to be concerned about.

As mentioned towards the beginning of this paper, the Turkish campaign against the PKK and the Kurds coincided with the agreement to allow the US military use of Turkish air bases to fight Daesh from Turkey. This has raised concerns regarding the Turkish government's true intentions – largely, the US is worried that the Turkish government is using the excuse of supporting strikes against fundamental Islamic militants by striking against the PKK, as the PKK are listed as terrorists. As discussed earlier, the president stood to gain politically at election time by quelling a Kurdish resistance and appealing to Turkish nationalists. As quoted by a senior Turkish official when discussing the desecuritisation of the Kurdish conflict:

“Turkey will share its experience with world leaders to seek support to prevent the Middle East from becoming a region that exports terrorism to the world... The Prime Minister will also highlight that certain countries and organisations should refrain from attitudes that encourage and support PKK and other groups for permanent stability in the Middle East.”

In essence, whilst the Turkish government has lent itself legitimacy by ensuring the case for maintaining the PKK's position on the terrorist organisation list is proven, it has taken the opportunity to request that its allies refrain from becoming involved. But this is not the only factor for Turkey's action against the Kurds. The Turkish military has been able to act with only minor criticism from its allies, and in the subsequent arguments, the responses of the US and the EU will be analysed.

It is pertinent to note that the US and the EU are the strongest allies of Turkey, and play two separate roles. The US is largely the military support, with its origins in the stationing of missiles on Turkish soil to contain the Soviets in the Cuban Missile Crisis. As noted earlier, the US needed the use of Turkish air bases in order to launch attacks on Daesh. Crucial to the American mission to combat Daesh has been the support of the Kurds in Rojava. The US has relied heavily on the Kurdish

People's Protection Units and Women's Protection Units (YPG and YPJ), and sacrificing their support to please Turkey is not in American interests.

The US has been attempting to wade through a political quagmire that has become the Syrian conflict. Daesh has claimed vast swathes of land across Syria and Iraq, but various groups are attempting to force Daesh to retreat. The US has been relying on the Kurdish militias, who have drawn troops from Iraq, Syria, Iran, and Turkey to help fight against Daesh. However, this has angered Turkey – Turkey views the Kurdish militias as terrorists, seeing as they have links to the PKK. These links are not well established nor are they easily seen: these links entail the interchangeable identities of fighters on the ground, some weaponry and financial support to the Kurdish militias, and political support for the Kurdish territories of Rojava. American support of the Kurdish militias in Syria has naturally angered the Turkish government, as the government does not believe there is a difference between Kurdish groups—they are all PKK affiliates, and are all threats.

The US, however, has valued the support of the Kurds enough that they have disregarded the Turkish government's objections to the American military's support of Kurdish troops. Earlier in 2016, the US military withdrew its support for a deal struck between Turkey and the US, that the US would support troops in Syria that are Arab. The US had fought alongside Kurdish troops enough to see that the Kurds were the more able and organised force in the region, and determined again that it was in American interests to support the Kurds in larger military operations. According to the US military, these operations were carried out with the support of the Turkish government, despite being angered by American indignation against siding with supposed terrorists.

There are tensions brewing between the US and Turkish governments over the issue of supporting Syrian Kurds – noticeably, the US has stayed relatively silent on the conflict in eastern Turkey. The US has requested that the Turkish military refrain from shelling Kurdish troops in Syria – the Turkish military frequently targets Kurdish militia that are attacking targets near the Turkish border, as Turkey believes these targets, once secured, could

strengthen the Kurdish hold on territory in northern Syria. Effectively, the US is having to support two allies, which are fighting each other. But the US has been silent on the issue of the Turkish-Kurdish conflict. The US has an interest in maintaining the support of both Turkey and the Kurds fighting in Syria. However, Turkey has more capacity to assist the US, by providing air bases and supply lines. The lack of any securitisation or politicisation of the Kurdish conflict may be partially respecting the wishes of the Turkish government, a strong NATO ally, as well as wishing to maintain relations with Turkey due to the strategic importance of Turkey in regional and global affairs.

The European Union and Turkey have a much deeper relationship, and the EU is largely the political and economic supporter of Turkey. Turkey conducts the majority of its trade with the EU in a Customs agreement from 1995; Turkey applied for EU membership in 1999, and has been working through the accession agreements since. The major strain in relations between the Turkish government and the EU is over the Syrian refugee crisis. To reiterate, Turkey has absorbed 2.73 million refugees from Syria and needs more support from allies to help deal with the rising cost of supporting the major influx of people into its territory. But many refugees have used Turkey as a transit country in order to make their way to the EU. As has been heavily publicised, the co-ordinated (or lack thereof) response to the refugee crisis has been draining on the EU and its member countries. As such, the EU and the Turkish governments have worked to arrange a deal on how to deal with the crisis. In the EU-Turkey Joint Action Plan, several crucial policy points include: the returning of refugees crossing from Turkey to Greece illegally; the agreement to resettle a refugee processed in Turkey into the EU for every refugee returned to Turkey from Greece, and a humanitarian assistance package of 3 billion EUR to help Turkey in settling, housing, and feeding Syrian refugees within its borders. This is in exchange for accelerating the accession process of Turkey into the EU, and the lifting of visa restrictions of Turkish nationals to travel in the Schengen zone.

The agreement has already encountered implementation issues due to concerns over human

rights abuses by the Turkish authorities of Syrian refugees – an issue that could be exacerbated should the EU criticise Turkey's involvement against its Kurdish population. Reportedly, Syrian refugees are facing starvation, imprisonment, and lack of access to medical treatment in Turkish internment camps, which the EU and its member states have criticised. The EU has withheld the relaxing of visa requirements for travel in the Schengen zone, due to these humanitarian concerns. The Turkish government has been steadfast, and has threatened to cancel the agreement entirely should the EU continue to refuse the deal's provisions.

Should the Turkish government unilaterally rescind its agreement to the EU-Turkey Joint Action Plan, this would cause all progress in mitigating the Syrian refugee crisis to crumble. The EU needs Turkish support in the crisis, but the loss of that support is nearing, as the Turkish government is dictating the rules to the EU. The EU allowed a certain amount of discretion for the Turkish government to determine who is sent to the EU and who is forced to stay. As of the present, the Turkish government has approved a disproportionate amount of ill and injured Syrians to travel to the EU, whilst banning Syrian academics and doctors from travel.

With the Turkish government requesting that its allies refrain from commenting or interfering in the Kurdish conflict, the EU is very nearly prevented from overriding Turkey and securitising the issue. The EU is dependent on Turkish support: should the Turks be angered further, the deal will fall apart. Yet the EU has been more vocal about the conflict than the US has been. In two statements, the EU has spoken out against the human rights abuses in eastern Turkey. From one MEP came the statement, "We also express our concern about the escalation of violence in the southeast of Turkey, which caused almost 400,000 people to leave their houses," and from the EU's Foreign Policy chief Federica Mogherini:

"There is a need to restart the Kurdish peace process. The European Union recognizes that PKK is a terrorist organization, but there is a need to re-engage from the Turkish authorities' side with the Kurdish political representatives and the ones that

express their position in a peaceful way.”

Perhaps most forceful in its convictions of the conflict is the Council of Europe, from which Nils Muiznieks commented after a visit to the region, “respect for human rights has deteriorated at an alarming speed in recent months in the context of Turkey’s fight against terrorism.”

However, these comments do not place the conflict into a realm that requires the EU to react. From the quotes above, it is clear that the EU has placed the conflict into a human security, or humanitarian, sphere, which only requires a diplomatic response from EU officials. As such, Turkey responded diplomatically, and nothing more has been said between the two parties regarding the conflict. The EU is unwilling to compromise Turkey’s support for dealing with the refugee crisis, and the Turkish government understands this, and knows it can act with impunity from the EU. The Turkish government has accumulated vast political capital with the EU, and has used that to its advantage in deflecting any real criticism by the EU.

In summary, the US and the EU face too great a risk when confronting the Kurdish conflict. Both actors are heavily invested in different respects in Turkey, and both depend on the support of the Turkish government for their security and foreign policy objectives to succeed. Yet both actors have manoeuvred the issue using differing methods, in spite of grudging support from the Turkish government. The US military has accepted that there are links between Kurdish militant groups and the PKK, and has gone against Turkey’s wishes in supporting the Syrian Kurds whilst maintaining silence as per the

Turkish-Kurdish campaign. For the EU, it cannot risk losing Turkey as an ally, as Turkey is the EU’s bridge to the Middle East. Therefore, it has commented on the bare minimum regarding the conflict, and politicised the issue as a humanitarian, not a security, threat.

Ultimately, Turkey has succeeded in both securitising the Kurdish conflict domestically whilst successfully desecuritising the conflict to its foreign allies. Turkey’s goal is to quell any sort of Kurdish and PKK resistance within its territory, as it views the PKK and the Kurds both as terrorists and illegal organisations that threaten Turkey’s society and nationality. As well, the conflict has become a matter of convenience for the president, as he was able to turn the conflict into votes for him during the November 2015 elections. Simultaneously, the Turkish government successfully convinced its allies that the conflict was not for their attention. This is due to both the US and the EU needing to maintain Turkey as an ally in the Middle East. Whilst this has come with some pushback by both the EU and the US, Turkey has maintained its stance and used its political capital as a key ally to fend off serious criticisms. The conflict is relatively young, and is part of a larger conflict spanning Syria and Iraq, but nevertheless it is pitting allies of the US against each other, and the US is forced to please both actors in order to accomplish its goals. As well, the EU is being forced to sit tight and not comment on the matter, as it cannot risk losing Turkey in the Syrian refugee crisis. The Kurdish conflict is splitting allegiances and forcing actors to prioritise foreign policy over human rights, and is indeed a security threat in the Middle East and European region.

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HEALTH AS A TRADE ISSUE: HOW THE CAMPAIGN FOR SOUTH AFRICAN ACCESS BROUGHT THE RIGHT TO HEALTH TO THE WORLD TRADE ORGANIZATION (WTO)

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ABSTRACT

Transnational advocacy networks played a crucial role in the acceptance of the right to health as a trade concern that takes precedence over intellectual property (IP) protections. The development and influence of this norm is reflected in international responses to the 1998-2001 South African litigation over access to medicines. In the process of pressuring an army of pharmaceutical firms to back down from an unjust legal challenge, the transnational advocacy network surrounding access to AIDS medicines transformed the case from a largely trade-focused issue to a human rights issue. The right to health was thus brought to the world of international trade.

“[N]o priority should be given to health over intellectual property considerations...”

European Commission Directorate General in response to WHO’s Revised Drug Strategy, October 5, 1998

“If the industry did seriously think it could reap large rewards from the poor, then presumably it would be busy producing medicines for developing country diseases – which everyone here agrees it abjectly fails to do... Focus on prices and patents and you miss the real issues... We need to keep new medicines coming on stream through the pipeline. I would argue that you don’t get that through tinkering with TRIPS.”

David Earnshaw, Director of European Government Affairs and Public Policy for SmithKline Beecham, at the 1999 Amsterdam Conference on Increasing Access to Essential Drugs, November 29, 1999

its Medicines and Related Substances Control Act in 1997, its healthcare system was dangerously poorly equipped to address the spread of HIV/AIDS.¹ A legacy of the apartheid era, the racially bifurcated system made access to medicines highly unequal, with wealthy whites the only demographic able to afford the small, exorbitantly priced stock of antiretroviral drugs (ARVs) available, even when the country had one of the highest rates of HIV infection in the world.² The South African amendment aimed to help the country cope with the growing AIDS crisis by permitting compulsory licensing and parallel imports, which allowed certain drugs to be manufactured locally and others to be imported from the cheapest sources available internationally.³ This effort to increase access to affordable medicines was framed by patent-holding pharmaceutical companies as a theft of their intellectual property (herein IP) and a threat to the profits needed to fund future innovation.⁴ In February of 1998, the South African

1 Lisa Forman, “A Transformative Power?” Order No. NR27989, University of Toronto (Canada), 2007. <http://search.proquest.com/docview/304751804?accountid=14771>. 269. See also: Alison Brysk, *Human Rights and Private Wrongs*, New York: Routledge, 2005, 95.

2 Alison Brysk, *Human Rights and Private Wrongs*, 95.

3 Ibid. Parallel imports may be done without the permission of the patent-holder, undermining tiered pricing mechanisms. See also: Ellen ‘t Hoen, “TRIPS, Pharmaceutical Patents and Access to Essential Medicines: Seattle, Doha and Beyond,” *Medecins Sans Frontieres Access Campaign*, July 24, 2003, 43. http://www.msfaccess.org/sites/default/files/MSF_assets/Access/Docs/ACCESS_article_TRIPSPatentsDohaBeyond_ENG_2003.pdf.

4 Susan K. Sell . and Aseem Prakash. “Using Ideas Strategically: The Contest between Business and NGO Networks in Intellectual Property Rights.” *International Studies Quarterly* 48:1 (2004): 160. http://resolver.scholarsportal.info/resolve/00208833/v48i0001/143_uistcbnniipr.xml. See also Ellen ‘t Hoen, “TRIPS, Pharmaceutical Patents and Access to Essential Medicines,” *Medecins Sans Frontieres Access Campaign*, 48.

Pharmaceutical Manufacturers Association and 40 international pharmaceutical companies took legal action against the South African government in order to have the law repealed on the grounds that it violated the South African Constitution and article 27 of the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS).⁵ Though the plaintiffs initially had the support of their home governments, this support was gradually reduced over time as public outrage mounted against the lawsuit, directed by the efforts of a transnational advocacy network of NGOs and patients' rights groups (herein NGO network).⁶ By April 19, 2001, the pharmaceutical companies terminated their legal action after the steadily escalating public relations crisis culminated in protests in 30 cities across the globe.⁷ The leaders of the NGO network framed their position on the South African case in the context of a new standard in international trade, one in which the right to health takes precedence over IP protection.⁸ By emphasizing the links between the right to

health, access to medicines, and drug patents, the NGO network was able to frame the South African amendment as supportive of patients, rather than destructive of patents.

In her work on norm development, Annika Björkdahl indicates that the influence of norms in international relations can be determined by examining patterns of behaviour and rhetoric in a given area.⁹ In this way, the impact of the emergence of the norm of the right to health taking precedence over IP protection can be seen reflected in changes to the US response to the case over time. The change in the way the US pursued the case against South Africa's alleged TRIPS violation changed to reflect the emergence and acceptance of the right to health as a trade concern that takes precedence over intellectual property protection, and serves as a barometer for the norm's development up to and following the legal battle.

Before TRIPS, intellectual property disputes were either handled domestically within countries or brought to the World Intellectual Property Organization (WIPO), but these were deemed insufficient by companies who believed that WIPO supported developing country policies at their expense, causing them to lose market share and profits abroad due to weak IP protections throughout the 1970s and 80s.¹⁰ In the 1980s, a network of corporations with an interest in a strong, coherent set of internationally binding IP protections began to link IP to fair trade, innovation, and prevention of counterfeiting and piracy, and pushed the US government to strengthen its stance against IP violations both domestically and around the world.¹¹ These efforts succeeded in part because many groups and commissions responsible for advising the US government on trade issues were headed by the leaders of

5 Article 27 states that "patents shall be available and patent rights enjoyable without discrimination as to the place of invention... and whether products are imported or locally produced." General Agreement on Tariffs and Trade. *Agreement on Trade-Related Aspects of Intellectual Property Rights*, Annex 1C of the Marrakesh Agreement Establishing the World Trade Organization, signed in Marrakesh, Morocco on April 15, 1994. Accessed March 25, 2015. https://www.wto.org/english/docs_e/legal_e/legal_e.htm#TRIPS.

6 Ellen 't Hoen, "TRIPS, Pharmaceutical Patents and Access to Essential Medicines," 43. The number of companies was reduced to 39 after a merger.

7 Alison Brysk, *Human Rights and Private Wrongs*, 96; Rachel L Swarns, "Drug Makers Drop South Africa Suit over AIDS Drugs," *The New York Times*, April 20, 2001. <http://www.nytimes.com/2001/04/20/world/drug-makers-drop-south-africa-suit-over-aids-medicine.html>; "5 March 2001: International Day of Action against Pharmaceutical Company Profiteering," *Treatment Action Campaign*, Accessed March 27, 2015. <http://www.tac.org.za/Documents/Other/mar5act.htm>; "Aids Activists Disrupt AI Gore's Announcement Of Presidential Candidacy: Protestors Demand Global Access To Anti-HIV Drugs And An End To Vice-President's Bullying Of South Africa" ACT UP, Accessed March 27, 2015. <http://www.actupny.org/actions/gorezaps.html>.

8 "39 Drug Companies vs South Africa: People die for lack of affordable drugs as inhumane industry ignores reality," MSF Access Campaign, March 5, 2001, <http://www.msfacecess.org/about-us/media-room/press-releases/39-drug-companies-vs-south-africa-people-die-lack-affordable>; "Drop the Case! Support the Struggle for Medicines in South Africa." March 8, 2001. <http://www.msfacecess.org/about-us/media-room/press-releases/drop-case-sup>

port-struggle-medicines-south-africa.

9 Annika Björkdahl, "Norms in International Relations: Some Conceptual and Methodological Reflections," *Cambridge Review of International Affairs* 15:1 (2002), 19; <http://go.utlib.ca/cat/7692839>.

10 Susan K. Sell and Aseem Prakash. "Using Ideas Strategically," 158. http://resolver.scholarsportal.info/resolve/00208833/v48i0001/143_uistcbnniipr.xml.

11 Sell, Susan K. and Aseem Prakash. "Using Ideas Strategically," 155. http://resolver.scholarsportal.info/resolve/00208833/v48i0001/143_uistcbnniipr.xml.

IP-reliant companies, like the Advisory Committee for Trade Negotiations (ACTN), which was chaired by the CEO of Pfizer, and which created a task force on intellectual property rights (herein IPRs) that included the leaders of IBM, Merck & Co, and the Motion Picture Association.¹² This created greater opportunity for interest groups with IP concerns to gain influence over US policy.

In 1984, the International Intellectual Property Alliance (IIPA) was formed to represent 1,500 IP-reliant companies under eight trade associations in lobbying for amendments to the 1974 Trade Act, making the case for IP protection as a matter of fairness in international trade, and arguing that the US economy was losing billions of dollars to counterfeiting, piracy, and unfair foreign laws.¹³ The IIPA, partnering with the Pharmaceutical Manufacturers of America, also argued that IP protections were necessary to promote innovation sustainably in the future.¹⁴ Throughout the late 1980s, a series of domestic and international actions were taken to promote greater IP protection in international trade.¹⁵ Domestically, the US made several amendments to Section 301 of its 1974 Trade Act to allow for the US Trade Representative (USTR) to impose restrictions on foreign governments whose policies restrict IP protections, and added a “Special 301” provision that requires the USTR to identify and report on countries whose policies create inadequate IP protection, listing the worst violators as “Priority Foreign Countries” and putting them on watch lists for potential sanctions.¹⁶ These changes extended

beyond American borders with the inclusion of IP matters on the agenda of the Uruguay Round of trade negotiations at the General Agreement on Tariffs and Trade (GATT), which culminated in the inclusion of TRIPS in an annex of the Marrakesh Agreement Establishing the World Trade Organization in 1994.¹⁷ The TRIPS Agreement, by establishing common international standards for IP protection, facilitated what the US was doing with the 301 mechanism, pressuring countries to repeal unfavourable policies in order to improve conditions for US companies operating abroad.¹⁸ The Pharmaceutical Research and Manufacturers in America (PhRMA) brought the South African amendment to discussions of bilateral trade between the US and South Africa, putting pressure on the American government to take a strong stance against parallel importation and other perceived violations of intellectual property rights and compelling the US Trade Representative (USTR) to put South Africa on a 301 watch list that made the country easier to sanction.¹⁹ Further, in October of 1998, a law was passed in the US that conditioned development assistance on whether steps were being taken to repeal the Amendment act.²⁰

In his work on the influence of norms on state behaviour, Audie Klotz highlights the role of non-state actors and transnational movements in driving norm development.²¹ The spread of HIV/

cial 301 watch lists to put sanction threats on developing countries like India, Brazil, Thailand, and Taiwan, whose emerging pharmaceutical sectors were beginning to compete with American ones for market share. See: Lisa Forman, “A Transformative Power?” 2007. 87-88. See also Alan Dunn and Bill Fennell to the Film and Television Action Committee, April 23, 2004, http://ftac.net/7-Special_301.pdf.

17 General Agreement on Tariffs and Trade. *Agreement on Trade-Related Aspects of Intellectual Property Rights*, Annex 1C of the Marrakesh Agreement Establishing the World Trade Organization, signed in Marrakesh, Morocco on April 15, 1994. Accessed March 25, 2015. https://www.wto.org/english/docs_e/legal_e/legal_e.htm#TRIPs.

18 Susan K. Sell . and Aseem Prakash, “Using Ideas Strategically,” 159.

19 William W Fisher III, and Cyril Rigamonti, “The South Africa AIDS Controversy,” 7.

20 Ibid. 7-8.

21 Audie Klotz, “Norms reconstituting interests: global racial equality and U.S. sanctions against South Africa,” *International Organization* 49:3 (1995), 452; <http://go.utlib.ca/cat/7719858>.

12 To help build their case, ACTN made use of a paper commissioned by IMB CEO John Opel and written by an economist named Jacques Gorlin to frame IP protections as a necessary part of setting trade standards. See Susan K. Sell and Aseem Prakash, “Using Ideas Strategically,” 156, 158.

13 The 309 percent trade deficit between 1980 and 1985 may have made the US more open to taking measures to protect trade. Sell, Susan K. and Aseem Prakash, “Using Ideas Strategically,” 156. See also: Preslava Stoeva, *New Norms and Knowledge in World Politics: Protecting People, Intellectual Property and the Environment*, New York: Routledge, 2010, 92.

14 Susan K. Sell . and Aseem Prakash, “Using Ideas Strategically,” 156. See also: Preslava Stoeva, *New Norms and Knowledge in World Politics*, 92.

15 Preslava Stoeva, *New Norms and Knowledge in World Politics*, 94.

16 After these amendments, the USTR made use of the Spe-

AIDS was an experience shared across the world, and access to antiretroviral drugs (ARVs) to treat the disease was central to the transnational movement that brought an end to the South African suit, resonating with the concerns of AIDS patients and their advocates everywhere.²² The NGO-led transnational advocacy network against the South African case founded their opposition to the suit on the right to health, which necessitates access to essential medicines.²³ The NGO network leveraged this existing norm's relevance in the South African case and linked the right to health to TRIPS implementation in their campaign. In South Africa, local groups established the Treatment Action Campaign (TAC), who attended the case as an *amicus curiae*²⁴ to frame the suit as a matter of profits being put before people while raising awareness publicly.²⁵ Abroad, MSF/Doctors without Borders led the Access Campaign, a multinational coalition that lobbied for the suit, as well as drug prices, to be dropped.²⁶ By connecting with relevant authorities, running public education initiatives, and making appeals to the existing normative framework, activist groups were able to effectively challenge the po-

sition of the pharmaceutical companies and generate support for the supremacy of the right to health over IP concerns.²⁷

Activists appealed to the existing normative framework, which included the right to health as embodied in Article 25 of the Universal Declaration of Human Rights, and drew connections between the right to health and trade-related aspects of IP in the context of access to AIDS medications in the South African case.²⁸ The South African amendment, which was first framed in terms of a theft of property and a barrier to innovation, would be framed as a matter of human equality and the right to health, norms that fit tightly within the existing normative framework in the US and the international community. The NGO network loosened support for the suit by framing the position of the pharmaceutical companies as being based on greed, as opposed to support for future innovations. The NGO network weakened the case for patents being the "lifblood"²⁹ of the pharmaceutical industry by seeking out information regarding whether or not it was truly feasible to reduce the price of drugs, concluding that much of the USD 10,000 price tag attached to a year's supply of HIV/AIDS medicines was unnecessary mark-up, as evidenced by Cipla, an Indian drug manufacturer that was willing to offer the same treatment for just USD 350.³⁰

Alongside efforts to undermine the pharmaceutical manufacturers' case through fact-finding, the NGO network made use of its resources, including its high-profile members such as Ralph

22 The co-founder of ACT UP, Eric Sawyer, was both an AIDS patient and a patient advocate who lobbied American Congress for better research funding and better drugs. See Sabin Russell, "New Crusade to Lower AIDS Drug Costs/ Africa's needs at odds with firms' profit motives," *SF Gate*, May 24, 1999. <http://www.sfgate.com/health/article/New-Crusade-To-Lower-AIDS-Drug-Costs-Africa-s-2929307.php>.

23 "Pharmaceutical Industry Must Stop Obstructing Access to Medicine in South Africa," MSF Access Campaign, Mar 1, 2001.

24 A friend of the court – a party with an interest in influencing the outcome of a legal action who offers valuable information or expertise without being a party to the case. See: "Amicus Curiae," Legal Information Institute, Accessed April 1, 2015. https://www.law.cornell.edu/wex/amicus_curiae.

25 Lisa Forman, "A Transformative Power?" 2007, 280.

26 Alison Brysk, *Human Rights and Private Wrongs*, 96. The Access Campaign, which brought together MSF, Oxfam, TAC, Health Action International (HAI), the Consumer Project on Technology (CPT), and numerous other groups, took the right to health to the trade negotiations table, highlighting TRIPS flexibilities and emphasizing that the right to health ought to take precedence over the right to patent protection. See Colin McInnes et al, *The Transformation of Global Health Governance*, New York: Palgrave Macmillan, 2014, 83.

27 The founders of CPT drew attention to their findings that many drug companies, notably Bristol-Myers Squibb, relied heavily on public funding in the research and development of new drugs. See Preslava Stoeva, "New Norms and Knowledge in World Politics," 92; and Susan K. Sell and Aseem Prakash, "Using Ideas Strategically," 164.

28 Ellen 't Hoen, "TRIPS, Pharmaceutical Patents and Access to Essential Medicines," 2003, 61.

29 As David Warr, associate director of tax and trade for drug maker Bristol-Myers Squibb put it. Sabin Russell, "New Crusade to Lower AIDS Drug Costs/ Africa's needs at odds with firms' profit motives," 1999.

30 Susan K. Sell .and Aseem Prakash, "Using Ideas Strategically," 162.

Nader, to get the attention of relevant authorities.³¹ In 1998, the leading NGOs in the network attended World Health Assembly (WHA), where they introduced some of their normative ideas, with the WHA quickly passing a new resolution supporting the idea that trade agreements should not threaten equitable access to medications.³² This validated the new norm and gave the network authority to spread it further.³³ The 2000 American presidential elections also offered an opportunity to raise the profile of the access to medicines issue in US policy.³⁴ Al Gore, who began his presidential campaign with a negative stance on the Amendment Act and the hope of winning campaign contributions from PhRMA, had a number of his campaign appearances visited by noisy protesters bearing slogans such as “Gore is killing Africans – AIDS drugs now.”³⁵ Soon after, Gore sent a letter to the Black Congressional Caucus indicating that a change of policy was in order, and that he supported the South African Amendment Act.³⁶

The NGO network also staged numerous public events and conferences, including one in Amsterdam in 1999 to parallel the World Trade Organization’s (WTO) Seattle ministerial meeting, which attracted activists and lobbyists from 50 countries, and produced a public statement that called for greater consideration of the impact of trade policies on health in developing countries, and for a working group to be established in the WTO to address TRIPS and access to medicines.³⁷ Over time, the network won further support

from the World Health Organization (WHO), who brought together the WHA to discuss a revised drug strategy in May of 1999.³⁸ Upon learning about the possibility of a revised drug strategy paving the way for future weakening of patent protections, the US sent not health policy experts, but trade negotiators to the discussions.³⁹ The NGO network predicted that this would happen, and met in advance to prepare their own negotiators to deliberate, bringing in evidence of compulsory licensing practices within the US that made the USTR’s position seem hypocritical.⁴⁰ On March 5, 2001, TAC led an international day of action against pharmaceutical profiteering that was joined by protest groups in a dozen countries.⁴¹ On March 8, MSF began circling an international petition calling on the plaintiffs to drop the suit.⁴² The petition garnered 250,000 signatures in a little over a month as MSF persuaded the EU, Dutch, German, and French governments to withdraw support for the suit and call for it to be dropped.⁴³ Throughout, the WHO helped provide legal assistance to aid South Africa’s defense, and Nelson Mandela’s criticisms of the plaintiffs made world news.⁴⁴

Throughout 1999, the US government removed South Africa from its watch lists and stopped pressures to repeal the amendment, while South Africa in turn assured the USTR that it would implement Section 15C in accordance with what was permitted by TRIPS.⁴⁵ In the same year, South Africa was removed from the Special 301 watch list, and at the WTO Ministerial in Seattle, President

31 Nader led the Consumer Project on Technology and was Al Gore’s political rival in the 2000 presidential bid. See Susan K. Sell and Aseem Prakash, “Using Ideas Strategically,” 162.

32 Ibid. 163.

33 Ibid. 163.

34 Ibid. 164.

35 “Aids Activists Disrupt Al Gore’s Announcement Of Presidential Candidacy: Protestors Demand Global Access To Anti-HIV Drugs And An End To Vice-President’s Bullying Of South Africa” ACT UP, Accessed March 27, 2015. <http://www.actupny.org/actions/gorezaps.html>. See also: Susan K. Sell and Aseem Prakash, “Using Ideas Strategically,” 165.

36 William W Fisher III, and Cyril Rigamonti, “The South Africa AIDS Controversy,” 8.

37 Ellen ‘t Hoen, “TRIPS, Pharmaceutical Patents and Ac-

cess to Essential Medicines,” 2003, 46.

38 Susan Sell and Aseem Prakash, “Using Ideas Strategically,” 163.

39 Susan Sell and Aseem Prakash, “Using Ideas Strategically,” 163-4.

40 Check Mate! Ibid.

41 “International Day of Action,” Treatment Action Campaign. Accessed March 27, 2015. <http://www.tac.org.za/Documents/Other/mar5act.htm>.

42 “Drop the Case! Support the Struggle for Medicines in South Africa.” *MSF Access Campaign*, March 8, 2001.

43 Lisa Forman, “A Transformative Power?” 2007, 286.

44 Ibid. 286.

45 William W Fisher III, and Cyril Rigamonti, “The South Africa AIDS Controversy,” 9.

Bill Clinton publicly announced plans to change US policy to improve access to AIDS medications in Africa, along with plans for the USTR to work more closely with the Department of Health and Human Services to ensure that US IP policy would become “flexible enough to respond to legitimate public health crises.”⁴⁶ Soon after, in May 2000, Clinton issued executive order 13155, which prohibited the US from seeking “through negotiation or otherwise, the revocation of any intellectual property law or policy of a beneficiary sub-Saharan African country, as determines by the President, that regulates HIV/AIDS pharmaceuticals or medical technologies.”⁴⁷ This represents a complete reversal of the US’s stance on the South African case and is indicative of a response to the normative pressures leveraged by the NGO network and the widespread public support it had gained for its cause.

After all this, the pharmaceutical companies capitulated, agreeing to end the suit and to cover South Africa’s legal expenses.⁴⁸ Leading up to the withdrawal, the CEO of GlaxoSmithKline met with UN Secretary General Kofi Annan to help broker a deal with the President of South Africa on behalf of the pharmaceutical group, with the EU and WHO firmly supporting South Africa.⁴⁹ With South African agreement to ensure TRIPS compliance moving forward, the lawsuit was dropped and AIDS activists celebrated the success of their efforts to frame the conflict as a matter of corporate greed impinging on the right to health for the poor.⁵⁰

Throughout the proceedings, the norm of the right to health taking precedence over intellectual property protection had emerged and been developed to reach a critical mass of support internationally. The NGO network used a variety of means to

create pressures from above, such as those created by WHA validation, and pressures from below, in the form of public protest and lobbying, which, given widespread support for the norm, reversed the US’s stance on the issue, bringing the norm to its tipping point into acceptance. According to the reflections of the 2004 president of the International Federation of Pharmaceutical Manufacturers and Associations on the reputation of the pharmaceutical industry, the AIDS epidemic was accompanied by the first conflict in which organized groups of patients and their supporters confronted companies about how much they would be allowed to charge for medications.⁵¹ This normative victory is reflected well in the provisions for global health and HIV/AIDS medicines in the Doha Declaration, which links the right to health to intellectual property and international trade, granting WTO members the right to grant compulsory licenses, permission to allow parallel imports, and the freedom to determine what constitutes a public health emergency that would justify making use of TRIPS flexibility⁵². The TRIPS agreement’s Article 30 permitted compulsory licensing in emergencies, but it was only after the Doha Ministerial in 2001 that public health crises were explicitly included as a national emergency that warranted Article 30 protection.⁵³ The acceptance of the right to health as an issue that warrants a place at the table in trade negotiations was explicit at Doha, which represented the institutionalization of the norm of the precedence of health over IP concerns, indicating that never again would violators be able to take for granted the unqualified support of their home government or of the WTO where their IP interests clashed with the health needs of a population.

46 Susan K. Sell . and Aseem Prakash, “Using Ideas Strategically,” 166. See also: William Clinton, Remarks to the luncheon in honor of the Ministers attending the Meeting of the World Trade Organization, December 1, 1999, White House Office of the Press Secretary, Found online at: <http://www.staff.city.ac.uk/p.willetts/PIE-DOCS/CLNT1299.HTM>.

47 See 65 Federal Register 30521 (May 10, 2000). <https://federalregister.gov/a/00-12177>.

48 William W Fisher III, and Cyril Rigamonti, “The South Africa AIDS Controversy,” 9.

49 Ibid. 9.

50 Ibid. 10.

51 William W Fisher III, and Cyril Rigamonti, “The South Africa AIDS Controversy,” 19.

52 William W Fisher III, and Cyril Rigamonti, “The South Africa AIDS Controversy,” 15.

53 Susan K. Sell .and Aseem Prakash, “Using Ideas Strategically,” 167.

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EXPLORING CONTRACEPTIVE SERVICE DELIVERY ON THE THAILAND-BURMA BORDER

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INTRODUCTION AND CONTEXT

Historical tensions have long existed between Thailand and Burma, due to colonialist rule that dates back to the end of World War II in 1945, and the self-determination of Burma, a former British Colony. Four years after the war, in 1949, an ethnic minority, the Karen Armed Forces, led a coup that resulted in direct military control of the government. Over time this has led to instability along the Thailand-Burma border and has reverberated into the early part of the twenty first century. This has been demonstrated by elections in 2010 that were regarded by the international community as important steps toward democracy, however the violent protests produced a human rights crisis^{1-2,12-13}. As a result of this ongoing instability in Burma's military and political systems a large portion of Burma's population has fled into Thailand for refuge. In 1988 the military seized power, democracy activists disappeared and thousands fled or were forced to go into hiding. Many thousands of migrants and refugees moved rapidly to the Thai-Burma border, seeking safety and protection. A steady flow of refugees and migrants from Burma (renamed Myanmar as of 1989 and recognized globally in 2010) into Tak Province, Thailand has occurred over the last 60 years. An estimated 100 000 Burmese refugees entered Thailand in 2010, and have been termed 'Internally Displaced Populations' (IDPs)^{1-2,12-13}.

Throughout Eastern Burma and Western Thailand, IDPs face many challenges to their survival, including food security issues (destruction of agricultural fields), forced labor, forced relocation, physical attacks by soldiers/authorities, and landmines. It is indicative in the literature that nearly eighty percent of women in Burma have never used contraceptives². As a result women in Burma are facing a vicious cycle of low contraceptive use resulting in unplanned pregnancies and effectively causing unsafe abortions and a high mater-

nal mortality rate. This cycle seen throughout the Thai-Burma border has a significant impact on the health care systems and potentially could even be worsening the problem of reproductive health care access. This structured literature review will explore issues related to contraceptive service delivery along the Thailand-Burma border^{1-2,12-13}.

RESEARCH QUESTION

This structured review of the literature seeks to address the question 'What barriers do women living along the Thailand-Burma border face when trying to access contraception?'

MATERIAL AND METHODS

A structured literature review was conducted using content sought in the databases MEDLINE, CINHALL and EMBASE. These databases were selected as due to their relevancy and appropriateness for the research question. Key words included contraceptives OR contraception, women, Myanmar OR Burma, Thailand and barrier*. Set limits included: Human studies, articles published in English, and articles published within the last 30 years. The preliminary search yielded 62 articles collectively from the three databases, which was reduced to 41 after removing duplicates. Articles were prioritized based on inclusion criteria defined by titles and abstract content. There were an additional 12 articles excluded after having read the abstracts. The researchers independently assessed the 31 remaining articles for full text relevancy. An additional 10 articles were omitted for they did not satisfy the inclusion criteria. Reasons for exclusion included location were not along the Thailand-Burma border; focus was on a disease, and did not discuss barriers to access. An additional 5 studies were included after reviewing bibliographies of the included articles, resulting in 24 articles as the final product. The researcher suspects that the addition-

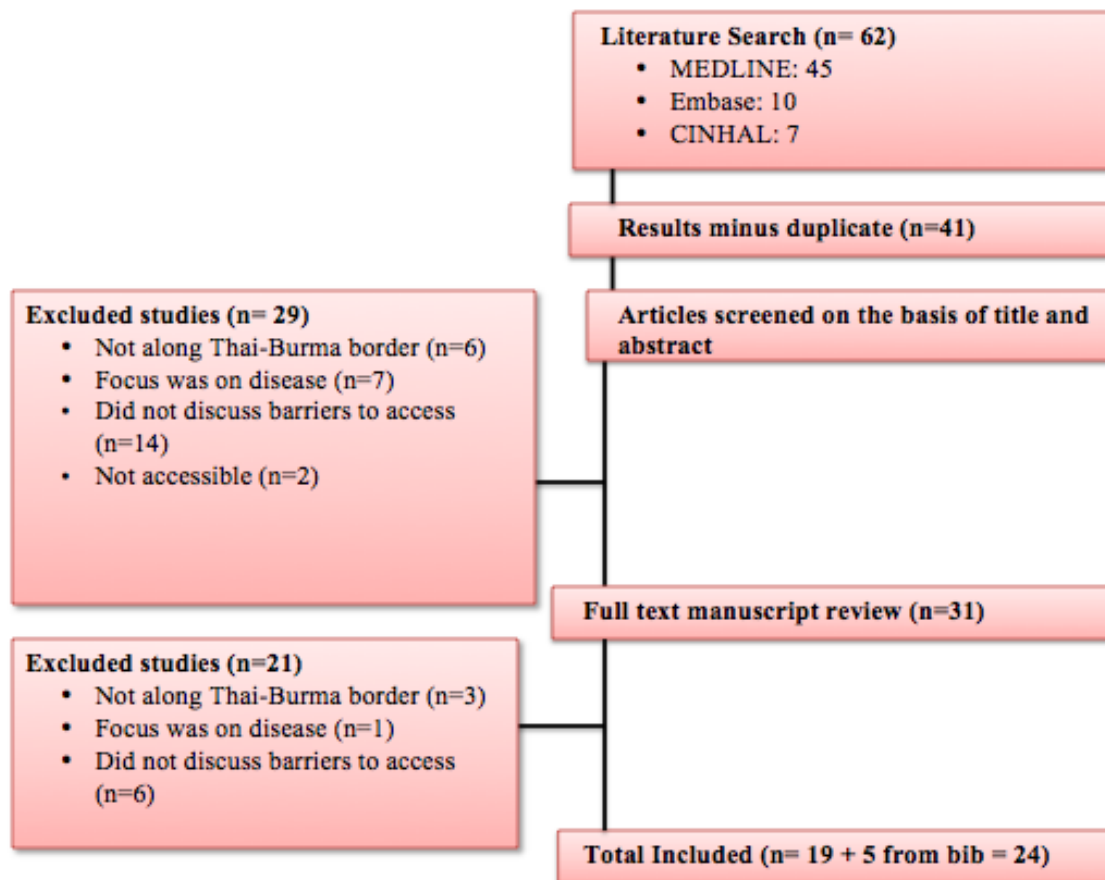


Figure 1. Review Profile and Study Selection Process.

al 5 studies retrieved from reviewing bibliographies were not captured in the initial search because the search terms and screening process may have been too narrow to capture all of the relevant articles.

Data Analysis

The qualitative content analysis used a thematic data analysis approach using inductive reasoning. NVivo, a qualitative software analysis program was used for coding and analysis involved standard steps in thematic analysis, where the coding categories were derived inductively from the literature using a constant comparative method. This allowed the researcher to not only stimulate original insights but also allowed apparent differences between categories to be made. In order to ensure reliability of coding categories, the research defined them in ways that are internally as homogeneous as possible and externally as heterogeneous as possible. In addition, the research developed and used a coding manual, which consisted of category names, definitions and basic rules for assigning codes. Due to the nature of the constant comparative method, the coding manual evolved through the data analysis

process. After all the data was coded, the researcher rechecked the coding to ensure consistency. This helped to ensure that the coders' understanding of the categories did not change over time.

RESULTS

Following the content analysis, five major barriers were expressed throughout the articles evaluated; these barriers include: legal, geographical, security, educational and socio-demographic. Table 1 represents a starting place for delineation.

Legal Barriers

Induced abortion is legal in Thailand and the laws surrounding abortion are viewed as less restrictive, however there is noteworthy inequality for Burmese women who live in Thailand and seek reproductive health care. The literature indicates that one of the reasons for this is their illegal status in the country²⁻⁴. The situation is even bleaker in Burma where abortions are only legal to save the life of a woman³. This is due to the Burmese government's pro-natalist views and their desire to increase their

Table 1: Major themes and their defining characteristics

Theme	Characteristics	Reference
Legal	<ul style="list-style-type: none"> - Abortion laws - Illegal residency status - Government pro-natalist views 	2-4
Geographical	<ul style="list-style-type: none"> - Limited services and private clinics in rural - Varying religious beliefs 	5,4,10,11
Security	<ul style="list-style-type: none"> - Travel distance and time - Risks of travel (e.g. rape, landmines or deportation) 	5,10,12,13
Education & Socio-Demographic	<ul style="list-style-type: none"> - Misinformation - Lack of awareness - Untrained staff - Marital status 	4,13-15

birth rates in order to have a larger population⁵. As a result of these laws that govern both Burma and Thailand, many face appreciable barriers to accessing contraceptives. This is most notable in Burma, where government health center do not offer information nor contraceptive products because of the government's pro-natalist view.

Geographical Barriers

In essence, it was discovered that rural areas have limited services and areas along the borders are significantly poorly served as these areas lack private clinics⁵, which as previously mentioned is one of the main ways to access contraceptives in Burma.

Migrant workers were often able to access contraceptives as well as women living in camps. However, most often these women do not access the products do to their religious and or cultural beliefs^{2,6,7}. Many women and NGO's expressed that the location from which women receive contraceptives can impact their choice of the contraceptive used. Pharmacies in Burma do not carry emergency contraceptives (ECPs) as a result of government regulations however Thailand pharmacies do carry said product with no prescription needed². In both locations women expressed a strong dislike towards receiving their contraception from pharmacies as they felt there was a lack of privacy and women were embarrassed⁸.

Mobile Health Units that travel throughout Burma were said to carry very little contraceptives as their main concern was for malaria and other life-saving medications^{2,9}. As a result of limited space, contraception therefore has taken a back seat. And although it was indicated that while some mobile health units are willing to pack specific contraceptives if women express a desire, most women feel a strong discomfort asking for the products⁹. Another issue regarding mobile health units was while they do travel extensive distances, they are often hesitant or unwilling to travel into conflict areas due to the significant threats it would pose, and as a result women in these areas are unable to access the contraceptives even if they did make a recommendation².

Private Clinics are relatively common in Burma and are one of the only ways in which Burmese women can receive contraceptives. However, a significant down side are the elevated costs associated with using these clinics^{4,10,11}.

Security Barriers

An elevated portion of women are required to travel in order to receive the proper contraceptives they need, however, traveling throughout the Thai-Burma border presents appreciable risks such as rape, landmines, and confiscation^{5,12}. Women expressed that travelling for a contraceptive method that is needed every 3 months or less is not practi-

cal and those who were aware of the IUD found it to be a more positive option because it cuts down on cost and travel time¹².

Migrant women living in Thailand also fear traveling long distances, as it requires public transportation. Not only is transportation an expensive cost in Burma, it also presents dangers being deported. Women explained that they could be deported if they don't have proper papers (ie. work permit) and often public transit gets stopped numerous times to check people for these therefore the risks do not outweigh the benefit in this case^{5,10,13}.

Educational Barriers and Socio-demographic Barriers

Women living along the Thai-Burma border expressed numerous times that misinformation and lack of awareness were of substantial barriers for them to receive the contraceptives needed. As it stands, there is no evidence-based knowledge (pinnacle of the research hierarchy) on various contraceptives and their uses. This is correlational with staff being not trained on the products and the various uses, pros and cons for various contraceptive methods. In addition, women expressed language to be a barrier at times, namely for migrants who do not speak or read Thai^{4,13,14}.

Furthermore, a large proportion of women were unaware that some contraceptives could be used in the prevention of diseases. Similarly, adolescent girls who have expressed that they are engaging in sexual activity as young as 13 years of age (with the average being around 18)¹⁵ were not receiving education on sex and sexual anatomy. As a result, these young women either stated not using contraceptives or were misusing contraceptives^{5,10,13}.

Marital status was an additional barrier that women along the Thai-Burma border face. Culturally there are negative attitudes towards young unmarried women using contraceptives, as it is a group of products viewed as only to be used by married couples or adult women^{13,15}.

DISCUSSION AND CONCLUSION

This review sought to discover what barriers exist for women along the Thai-Burma border who seek contraceptives; six main barriers were discovered.

Work is being done by various NGO's and the United Nations to improve access to contraceptives however little to no work is being done to decrease the rights violations of these women⁵. It is my belief that if efforts were additionally focused here women would face significantly less barriers and would eventually be able to have the access to contraceptives that they need and deserve. An additional area of focus is educating workers in both Burma and Thailand, along with women, men and adolescents on the importance of contraceptive use. Education is needed to change the societal view and to make reproductive health a priority. Similarly, training tailored to conflict areas is needed, as knowledge is different and low in crisis areas.

Work needs to be done on a local and global scale to improve the situation for women in the Thailand-Burma border. There is still a serious requirement for political, and policy overhauls in order to properly train and equip frontline health workers. This should begin with education-based programs to eliminate the stigmatization surrounding the issue.

As with any research, limitations were identified in this study. The articles obtained were limited to those accessible through the University of Ottawa Search+ databases. Additionally, only studies published in English were used. The publication date ranged from 1985-November 2015, thus providing a 20-year span. This creates a limitation because data published outside this time period was rejected. Also, some selected articles published within this time span, conducted their research many years prior to publication. This time range creates the potential for outdated data. In addition, data from certain studies had potential biases affecting results. More specifically, there were studies that used self-reported questionnaires as the main sources of data, creating the potential for response bias. An additional limitation is that the research was conducted only in English.

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ISOLATION OF PHOMOPSOLIDE A AS THE ANTIMYCOBACTERIAL CONSTITUENT OF AN UNIDENTIFIED ENDOPHYTE OF THE CANADIAN MEDICINAL PLANT *GEUM MACROPHYLLUM*

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ABSTRACT

An extract of an unidentified green filamentous fungus isolated as an endophyte of the Canadian medicinal plant *Geum macrophyllum* exhibited significant antimycobacterial activity and a distinct ¹H NMR profile. Bioassay guided fractionation indicated that the natural product phomopsolide A (**1**) was responsible for the distinguishing characteristics of the extract.

INTRODUCTION

There is an urgent need for new antibiotics as the number of infections caused by resistant microbes continues to increase at an alarming rate (World Health Organization, 2015). Tuberculosis (TB) is particularly problematic given its global prevalence, the widespread emergence of drug-resistant strains of *Mycobacterium tuberculosis* and the burden that the disease places on healthcare systems worldwide (World Health Organization, 2014). Endophytic fungi, particularly those from medicinal plants, are an excellent source of potential drug leads that produce natural products with significant antimicrobial properties (Demain and Sanchez, 2009; Kaul et al. 2012; Deshmukh, Verekar, and Bhave, 2015). In previous work, Ellsworth et al (2013) isolated 81 endophytes from the leaves of plants traditionally used as medicines by the First Nations of the Canadian Atlantic Provinces. Extracts of the fungi were screened for antibiotic activity (Ellsworth et al., 2013) and chemically unique extracts were identified using NMR-based metabolomic analyses (Clark et al., 2014). One of the extracts highlighted in the metabolomic screening

displayed significant antimycobacterial activity and was derived from an unidentified green filamentous fungus (isolate TC2-085) isolated from the large-leaved avens, *Geum macrophyllum*. This report describes the bioassay guided fractionation of the TC2-085 extract with the objective of isolating the constituents responsible for its antimycobacterial activity.

RESULTS

Fractionation of the TC2-085 extract by liquid-liquid partition followed by normal phase HPLC yielded compound **1**, which had an IC₅₀ of 35 μM against *M. tuberculosis* H37Ra (Figure 1). The molecular formula of **1** was determined to be C₁₅H₁₈O₆ by high-resolution electrospray mass spectrometry and indicated seven degrees of unsaturation in the molecule. Examination of the ¹³C NMR spectrum of **1** allowed six degrees of unsaturation to be assigned to the presence of three carbonyl groups (δ_c 202.2, 166.6 and 162.1) and three carbon – carbon double bonds (δ_c 143.0, 141.1, 139.7, 127.6, 124.6 and 124.3), implying that **1** must also contain one ring. The ¹H NMR revealed the presence of two vinylic methyl groups [δ_H 1.78 (d, *J* = 6.3 Hz) and 1.77(bs)], a methyl group coupled to an oxymethine [δ_H 1.38 (d, *J* = 7.1 Hz) and 4.34 (q, *J* = 7.1 Hz)], two mutually coupled oxymethines [δ_H 5.97 (dd, *J* = 5.9, 2.8 Hz) and 5.64 (dd, *J* = 5.4, 2.8 Hz)] and five vinylic protons [δ_H 7.08 (dd, *J* = 9.7, 5.9 Hz), 6.84 (m), 6.41 (2H, m) and 6.23 (d, *J* = 9.7 Hz)]. Based on the observed molecular formula and the structural features highlighted by

NMR spectroscopy, compound **1** was determined to be phomopsolide A (Figure 2) and its identity was confirmed by comparison with literature data (Grove, 1985; Stierle et al., 1997).

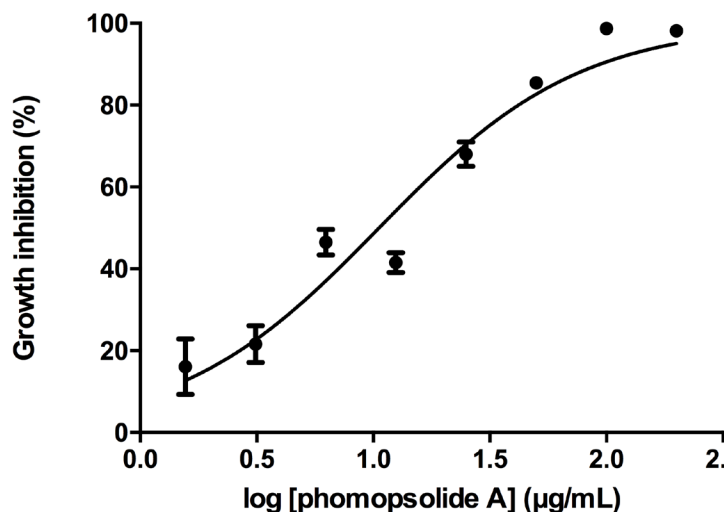


Figure 1. The effect of Phomopsolide A (**1**) on the growth of *Mycobacterium tuberculosis* H37Ra. Growth inhibition was assessed *in vitro* using a microplate resazurin assay at eight concentrations ranging from 200–1.625 µg/mL in triplicate. Data is shown as the mean percentage inhibition and error bars represent the 95% confidence intervals of the mean.

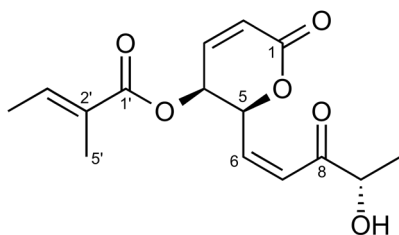


Figure 2. The structure of phomopsolide A (**1**)

DISCUSSION

Phomopsolide A was first described as a natural product of the fungus *Phomopsis oblonga* isolated from elm trees (Grove, 1985) that prevented beetles from eating the tree (O’Callaghan, Atkins and Fairhurst, 1984; Claydon, Grove, and Pople, 1985). It has since been reported from a *Penicillium* sp. isolated from the bark of the pacific yew *Taxus brevifolia* (Stierle, Stierle, and Ganser, 1997), from *Penicillium clavigerum* isolated from the alga *Chlorella vulgaris* (Stierle et al., 2014), and from an unidentified fungus isolated from the cow parsnip *Heracleum maximum* (Clark et al., 2015). Although this phomopsolide A exhibits antimycobacterial

activity, it also toxic to human HEK293 cells (Clark et al., 2015) making it an unlikely candidate for further research and development. Future research will therefore focus on exploring other isolates in our fungal library in an effort to discover novel bioactive compounds.

METHODS

All solvents were ACS reagent grade or HPLC grade. Normal phase HPLC was performed using a Waters® 510 pump, a Phenomenex® Luna® silica column (10µm, 100 Å, 250 10 mm) and a Waters® R401 refractive index detector at a flow rate of 4 ml/min. NMR spectra were recorded at 25 °C on an Agilent 400-MR DD2 NMR spectrometer with chemical shifts reported in ppm and were referenced to residual protonated solvent resonances using MestReNova® 6 (Mestrelab Research® S.L.). HRESIMS data were recorded on a Thermo Scientific® LTQ Exactive Orbitrap mass spectrometer. Optical rotations were determined on an Optical Activity Ltd. AA-10 polarimeter and IR spectra were recorded on a Perkin Elmer Spectrum Two FT-IR spectrometer as thin films on sodium chloride disks.

Antimycobacterial assays and median inhibitory concentration determinations were performed in triplicate against *M. tuberculosis* H37Ra as described by O’Neill et al. (2014) using rifampin (0.1 µg/mL) and 2% DMSO as the positive and negative controls, respectively. Fractions that inhibited the growth of *M. tuberculosis* by more than 50% when tested at 100 µg/mL were considered to be bioactive. MICs and IC₅₀ were determined on dilution series comprising 8 concentrations (200–1.625 µg/mL) in triplicate. The MIC of a compound was considered to be the lowest concentration at which it inhibited mycobacterial growth by more than a mean value of 90% (Collins & Franzblau, 1997), and the corresponding IC₅₀ was estimated by fitting a four parameter logistic curve (Sebaugh, 2011) to the mycobacterial growth data using GraphPad Prism version 6 (GraphPad Software, California, USA).

The isolation TC2-085 from *Geum macrophyllum* and attempts to identify the fungus have been previously reported (Ellsworth et al. 2013). TC2-085 was fermented in 2% malt extract broth (200

ml; 2 × 100 mL batches in 250 mL Erlenmeyer flasks closed with foam stoppers) with shaking (150 rpm) at room temperature under ambient light for 2 weeks. The fungal material and spent fermentation broth was sonicated for thirty seconds before being filtered through cotton wool, extracted with EtOAc (3 × 60 ml) and the combined organic phases concentrated *in vacuo* to give a fungal extract (34 mg). The extract was dissolved in 9:1 MeOH/H₂O (5 ml), extracted with hexanes (3 × 2 ml), the aqueous fraction further diluted with H₂O (2.5 ml) and the resulting 3:2 MeOH/H₂O suspension extracted with CH₂Cl₂ (3 × 2 ml) before being concentrated *in vacuo*, taken up in H₂O (5 ml), and extracted with EtOAc (3 × 2 ml) and finally n-BuOH (3 × 2 ml). All five of the resulting fractions were concentrated *in vacuo*, and assayed for antimycobacterial activity. The CH₂Cl₂ fraction exhibited significant bioactivity and was further purified by normal phase HPLC (60:40 Hexane:EtOAc) resulting in the isolation of compound **1** (18 mg).

Spectroscopic and spectrometric data obtained for **1**: [α]_D²²: +313 (c 0.24, MeOH); IR (NaCl): 3451, 2928, 1715, 1647, 1252, 1130, 1067 cm⁻¹; ¹H NMR (400 MHz, CDCl₃) δ 7.08 (1H, dd, *J* = 9.7, 5.9 Hz, H-3), 6.84 (1H, m, H-3'), 6.41 (2H, m, H-6 and H-7), 6.23 (1H, d, *J* = 9.7 Hz, H-2), 5.97 (1H, dd, *J* = 5.4, 2.8 Hz, H-5), 5.64 (1H, dd, *J* = 5.9, 2.8 Hz, H-4), 4.34 (1H, q, *J* = 7.1 Hz, H-9), 1.78 (3H, d, *J* = 6.3 Hz, H-4'), 1.77 (3H, bs, H-5'), 1.38 (3H, d, *J* = 7.1 Hz, H-10); ¹³C NMR (100 MHz, CDCl₃) δ 202.2 (s, C-8), 166.6 (s, C-1'), 162.1 (s, C-1), 143.0 (d, C-6), 141.1 (d, C-3), 139.7 (d, C-3'), 127.6 (s, C-2'), 124.6 (d, C-2), 124.3 (d, C-7), 77.0 (d, C-5), 73.3 (d, C-9), 63.3 (d, C-4), 19.7 (q, C-10), 14.7 (q, C-4'), 12.1 (q, C-5'); HRESIMS *m/z* 317.1000 [M + Na⁺] (calculated for C₁₅H₁₈O₆: 317.0996; Δ ppm 1.26).

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PROMOTING ANGIOGENESIS AND NEUROREGENERATION IN A VASCULAR DEMENTIA MODEL VIA HIF-1 TRANSCRIPTIONAL REPRESSOR PRMT1

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BACKGROUND

Vascular Dementia (VaD) is the second most common cause of dementia and accounts for up to 20 percent of diagnosed cases in the USA (Rohn, 2014). VaD is characterized by the loss of cognitive function due to a variety of cerebrovascular or cardiovascular conditions that lead to ischemic, hemorrhagic, or hypoperfusive brain lesions (Roman, 2003; Choi et al., 2016). One key feature of VaD that contributes to its pathophysiology is hypoxia, or reduced oxygen supply to tissues.

Risk factors associated with VaD include increasing age, history of heart attack, stroke, high cholesterol, and blood pressure (Duron and Hanon, 2008). Diagnosis of VaD relies on numerous criteria such as cognitive loss, vascular brain lesions identified by imaging techniques, and the ability to rule out alternative causes of the dementia (Tang et al., 2004; Pantoni and Inzitari, 1993; Roman, 2003). However, the diagnosis of VaD is often difficult due to its heterogeneous nature and co-existence with other neurodegenerative disorders like Alzheimer's disease (Marcelo and Bix, 2015). Currently, no treatments options exist for VaD, although known therapeutic candidates like dextromethorphan have been shown to alleviate oxidative effects in rat models of VaD (Xu et al., 2016; Li and Zhang, 2015).

The following proposal identifies a therapeutic avenue that may work to restore functional brain vasculature, and promote neural tissue regeneration in VaD patients. A previously identified protein is known to be involved in regulating the expres-

sion of an angiogenesis-promoting factor. Hence, it is postulated that targeted silencing/knockdown (KD) of this protein in brain endothelial cells (ECs) may provide a means to induce angiogenesis and the repair or regrowth of nervous tissues in a murine VaD model (Figure 1). This research may further elucidate the role of angiogenesis and brain ECs in promoting nervous tissue regeneration and may represent a way to alleviate cognitive deficits associated with VaD.

LINKING ANGIOGENESIS AND BRAIN NEUROGENESIS/GLIOGENESIS

Blood vessels (BVs) are critical for delivering nutrients and oxygen to tissues throughout the body efficiently and in a regulated manner. BV abnormalities can cause serious complications like those involved in the pathophysiology of VaD. Multiple studies suggest that BV angiogenesis, or the generation of new vessels from pre-existing ones, is linked with nervous tissue outgrowth and maintenance (Carmeliet, 2000; Vasudevan and Bhide, 2008; Tam and Watts, 2010; Eichmann and Thomas, 2013). Both the nervous system and BVs appear to closely associate with one another at the anatomic and cellular level, and recent evidence indicates that they share similar guidance cues during development (Tam and Watts, 2010; Carmeliet and Tessier-Lavigne, 2005). The coevolution of these systems strengthens the role of BVs in establishing a suitable microenvironment for neural cell proliferation and survival. As a result, studies focusing on pro-angiogenic factors may represent a means

to treat or reverse detrimental effects associated with VaD by reducing hypoxia-associated disease progression.

Compensatory angiogenesis can occur in VaD models, but these BVs are often unable to cope with hypoxic conditions (Marcelo and Bix, 2015). Pro-angiogenic factors such as vascular endothelial growth factor (VEGF) can be examined to assist endogenous cellular mechanisms that respond to hypoxia. VEGF is a protein that is known to play a crucial role in angiogenesis by promoting EC proliferation, migration, and tube formation (Miyamoto et al., 2014). VEGF has also been shown to play a key role in brain angiogenesis and vasculature organization (Raab et al., 2004). Importantly, ECs secrete soluble factors that are known to induce neural stem cell proliferation (Shen et al., 2004; Schanzer et al., 2004). Hence, EC outgrowth and vessel regeneration may lead to neuroregeneration indirectly. Alternatively, VEGF expression also directly influences neuron and glial cell growth, survival, and axonal outgrowth, suggesting its involvement in neural regeneration (Carmeliet and Storkebaum, 2002). One example of VEGF-mediated neural guidance is seen in its ability to bind to neuropilin-1 and neuropilin-2 (Crivellato, 2011). Neuropilin receptors assist axonal outgrowth during development by responding to guidance cues. VEGF's ability to bind to neuropilin receptors further supports its role in neurogenesis. Other secreted molecular signals such as Ephrins, Netrins, and Slits also guide both vascular and neuronal development (Eichmann et al., 2005). Together, EC-directed guidance and VEGF signaling highlight the potential role of vasculature in neural repair or regrowth.

In order to induce angiogenesis in target ECs, direct and indirect methods can be studied. Previous findings indicate hypoxia-inducible factor-1 (HIF-1) is able to upregulate Vegf transcription under hypoxic conditions (Forsythe et al., 1996). HIF-1 is a heterodimeric protein of the basic helix-loop-helix family composed of two subunits, HIF-1 α and HIF-1 β (Wang et al., 1995). It is a transcriptional activator of genes involved in cellular responses to changes in blood oxygen (Semenza, 2001). A recent study has implicated the involvement of arginine methylation in transcriptional repression of Hif-1, specifically by protein arginine N-methyltransferase 1

(PRMT1) (Lafleur et al., 2014). Here, the authors demonstrated that KD of Prmt1 significantly upregulated transcription of Hif-1 and Vegf. PRMT1 is responsible for the majority of arginine methylation that occurs in cells (~85%) and facilitates the role of this post-translational modification in transcriptional activation, repression, and more (Bedford and Clarke, 2009). Given this knowledge, targeted silencing to reduce Prmt1 expression in brain ECs may represent a viable method to moderately stimulate angiogenesis via intermediary activation of Hif-1 and Vegf. Next, ECs must be able to signal to surrounding neural cells to promote neuroregeneration. This is possible through the production and secretion of neurogenic or gliogenic factors. In this proposal, two EC-secreted neurogenic/gliogenic factors will be discussed.

ECs secrete artemin and neurotrophin-3 (NT-3), which both act to guide axonal outgrowth (Honma et al., 2002; Kuruvilla et al., 2004). Artemin is a glial cell line-derived neurotrophic factor whose expression promotes the survival of sensory and sympathetic neurons (Baloh et al., 1998). Meanwhile, NT-3 is a neurotrophic factor that binds to receptor tyrosine kinases of the trk family and is known to trigger events such as neuronal differentiation and neurite fasciculation in cortical precursor cells (Segal and Greenberg, 1996). NT-3 also plays a role in mediating the survival and proliferation of oligodendrocytes (Heinrich et al., 1999), the central nervous system-myelinating glial cell. The proposed roles of artemin and NT-3 represent ways by which ECs can direct outgrowth of precursor neural cells. ECs may also secrete VEGF leading to neural outgrowth in adjacent tissues. Bocci et al. (2001) indicate that placental ECs may use VEGF for autocrine signaling. Given VEGF's involvement in cell-cell signaling, it is possible that it may also act on neural cells. Thus, low-level induction of Vegf via Prmt1 KD may initiate angiogenesis and neuroregeneration in brain-injured VaD patients.

ASSESSING THE THERAPEUTIC POTENTIAL OF PRMT1 TARGETING IN VITRO

Traditionally, the first step towards establishing a novel therapeutic for any disease involves the identification of a target. When doing this, many remain

mindful of our current inability to reliably overexpress genes in humans. As a consequence, targets that can be knocked-down (KD) are commonly chosen. In this proposal, Prmt1 KD can be examined in VaD. After target identification, one may then test its therapeutic potential via *in vitro* and *in vivo* studies.

To investigate if Prmt1 KD can induce EC proliferation, migration, and tube formation *in vitro*, HUVEC and HMEC-1 human EC lines can be employed. Prmt1 KD may be achieved through Dicer-substrate small interfering RNA (DsiRNA) specific for the Prmt1 gene and a scramble negative control (NC) duplex. In conjunction with DsiRNA, Prmt1-specific antisense oligonucleotides (ASOs) can also be examined. These studies will assess the angiogenic potential of Prmt1 KD. If angiogenic potential is confirmed, *in vivo* experiments utilizing a murine VaD model should be pursued to examine neuroregenerative effects.

To provide a baseline for further functional studies, basal Prmt1, Hif-1, and Vegf transcription, as well as protein expression, should be confirmed in HUVEC and HMEC-1 cell lines by quantitative reverse transcription polymerase chain reaction (RT-qPCR) and western blot. Gene expression Taqman assays, along with Hrpt1 and Gapdh reference genes can be used for normalization. Based on primary literature research, antibodies for western blot and immunocytochemistry should be determined. In order to assess transcript levels, RNA from each cell line must be extracted and reverse transcribed into cDNA. Data can then be normalized to controls using the $2^{-\Delta\Delta Ct}$ method. Basal protein levels can be determined by western blot using enhanced chemiluminescence for visualization with beta-actin or vinculin as loading controls. If sufficient expression of the target (Prmt1) is observed, KD of Prmt1 at the transcript and protein level should be confirmed. To do this, cells must first be transfected with anti-Prmt1 DsiRNA, NC duplex, or select Prmt1 ASOs. A lipofectamine transfection reagent control should also be included. Forty-eight hours post-transfection, RNA and protein may be extracted and RT-qPCR and western blot should then be employed to assess target expression. If sufficient gene KD is achieved (>80% transcript silencing), upregulation of Hif-1 and Vegf should be

tested in silenced samples (RT-qPCR and western blot). Subsequently, *in vitro* proliferation, migration, and tube formation assays can be conducted. If target KD is not observed using DsiRNA/NC duplex or ASOs, alternative siRNA or ASO formulations may be pursued. Additionally, other putative PRMT1 targets may be tested through KD as well.

EC proliferation *in vitro* can be measured in Prmt1 silenced cells using a CellTiter 96 Aqueous One Solution Cell Proliferation Assay. This colorimetric assay works by measuring the reduction of an MTS tetrazolium compound to a media-soluble colored product. Absorbance can be read in cells transfected with appropriate treatments and controls seventy-two hours following incubation with MTS reagent. Cells should be visualized prior to incubation with the reagent to avoid cell clustering as this will significantly influence the way the cells utilize the reagent. If target KD increases EC proliferation, migration can be assessed. However, if there is minimal to no effect, alternate assays, including the MTT assay, or alternate cells, such as the human brain microvascular endothelial cell line ACBRI 376, should be considered. Additionally, caspase-3/7, -8, and -9 activities can be measured to rule out apoptosis as a player in reduced proliferation counts in treated cells. This can be done using Caspase-Glo 3/7, 8, or 9 Assays, which generate a luminescent signal from caspase cleavage of a proluminescent substrate added to cells. Results of the caspase assay(s) are consequently normalized to MTS data to determine caspase-3/7, -8, or -9 activities per cell. DMSO can be used as a positive control for apoptosis. Prmt1 silenced EC proliferation and apoptosis can be compared under normal and hypoxic (1% O₂) conditions to see if the treatment (Prmt1 KD) can suppress hypoxia-induced EC apoptosis. CellEvent Caspase-3/7 Flow Cytometry Assays can also be employed using hypoxic cells should the previous assays reveal inconclusive results. Considering the importance of hypoxia in VaD, these critical tests may reveal more about the role of PRMT1 in ECs, and subsequently its role in the pathophysiology of VaD.

If effective Prmt1 KD does increase EC proliferation and does not activate caspase-dependent apoptosis, migration assays can be performed. *In vitro* scratch/wound assays are commonly used

to assess cell migration as described by Liang et al. (2007). ECs can be plated and transfected with appropriate treatments and controls, and green fluorescent protein may be used as a transfection marker. A scratch is then made across the plate and periodic measurements of cell movement are made for up to 24 hours. If Prmt1 KD increases EC migration as indicated by faster scratch closure compared to controls, a tube formation assay can be conducted as a final confirmation of the former assays. The tube formation assay is a comprehensive *in vitro* experiment involving cell migration, proliferation, invasion, and more (Arnaoutova and Kleinman, 2010). However, if Prmt1 KD does not appear to influence migration of the aforementioned EC lines, another EC migration assay (EMD Millipore) can be tested.

Ultimately, Prmt1 KD should upregulate Hif-1 and Vegf in ECs. This should drive EC proliferation, migration, and tube formation indicative of angiogenesis, and play a role in driving subsequent neural outgrowth *in vivo*. Direct introduction of VEGF *in vitro* can also support the role of this mechanism in EC proliferation, migration, and tube formation.

PRMT1 AND ITS EFFECTS ON NEUROGENESIS/GLIOGENESIS IN A MURINE MODEL OF VASCULAR DEMENTIA

Following studies in cultured cells, *in vivo* delivery of anti-Prmt1 DsiRNA should be considered to assess its therapeutic potential. If Prmt1 KD is successful, lipoprotein-assisted delivery can be employed to selectively deliver DsiRNA to brain ECs. Kuwahara et al. (2011) show intravenous (IV) delivery of lipoprotein-siRNA complexes to brain capillary ECs via receptor-mediated uptake mechanisms. Similar techniques would facilitate the study of Prmt1 KD on brain vasculature and neural tissue regeneration in a murine VaD model. To expand the feasibility of this research, direct overexpression of Vegf *in vivo* can also be accomplished using an adeno-associated viral (AAV) vector containing human Vegf cDNA. However, for this proposal, only lipoprotein-mediated delivery *in vivo* will be considered.

To begin *in vivo* experiments, a control experiment utilizing C57BL/6 mice should be conducted to identify any adverse effects of PRMT1 KD *in vivo*. Following this, C57BL/6 mice of similar gender and age should then be subjected to total bilateral carotid artery occlusion (BCCO) and isoflurane-induced hypotension to generate a VaD model as previously published (Wang, 2014). The mice can then be separated into groups based on average body size. Lipoprotein is then isolated from the sera of untreated (WT-C57BL/6), Prmt1 silenced (Prmt1KD-C57BL/6), and NC (scramble) duplex (Sc-C57BL/6) mice by similar means as described (Kuwahara et al., 2011). A single dose of DsiRNA- and NC-lipoprotein complexes can be introduced intravenously by tail vein injection into respective animal groups. Using this VaD model, the effects of Prmt1 KD on murine angiogenesis and neuroregeneration (neurogenesis/gliogenesis) can be investigated.

In order to determine if target KD does in fact provide any therapeutic benefit via stimulating active cell division *in vivo*, bromodeoxyuridine (BrdU) labeling can be examined. BrdU is an analog of thymidine and is incorporated into newly synthesized DNA of actively dividing cells (Lehner et al., 2011). Double-fluorescent immunolabeling using markers for ECs, neurons, astrocytes, mature oligodendrocytes, and oligodendrial precursor cells may be employed (Yang et al., 2006). Target DsiRNA can be administered to WT-C57BL/6, Prmt1KD-C57BL/6, and Sc-C57BL/6 mice by IV injection for a set time frame following dosage optimization. After BrdU incorporation by IV injection, coronal hippocampal brain sections should be prepared for staining (Pan et al., 2013). Respective brain sections are then incubated with BrdU antibody in combination with one of the following antibodies against vWF (ECs), neuron-specific nuclear protein (neurons), GFAP (astrocytes), chondroitin sulfate proteoglycan (oligodendrial precursors), or adenomatous polyposis coli (mature oligodendrocytes) (Yang et al., 2006). Hippocampal brain sections that stain positive for BrdU and other markers are lastly quantified by fluorescence microscopy seeing as these are among the most sensitive regions of the brain to ischemic events and hypoxia (Hossmann, 1999). If Prmt1-silenced tissues exhibit elevated EC and neural cell

presence compared to control tissues, Prmt1 KD is sufficient to induce either or both neurogenesis and gliogenesis *in vivo*. Some brain sections can also be stored in RNAlater solution for examining Prmt1, Vegf, and Hif1 expression via RT-qPCR to confirm target KD. This will ensure any beneficial effects noted are a result of Prmt1 silencing. Lack of EC or neural cell proliferation with sufficient target KD may indicate that Prmt1 is an undesirable target. However, if the model tissues lack target KD and therapeutic effect, alternative methods of delivery can be considered. Recent evidence supports the use of polysorbate 80-directed nanoparticles for systemic delivery of siRNA to brain microvascular ECs (Wang et al., 2005).

In addition to assessing actively dividing cells, proliferation and caspase-mediated apoptosis can also be determined in coronal brain sections by Ki67 and caspase-3 (Cas3) staining for immunohistochemical analysis. Resulting sections can then be compared with BrdU-labeling to identify cells that may be undergoing apoptosis or are actively proliferating. If elevated levels of EC or neural cell populations stain positive for Ki67, BrdU, and their specific markers in PRMT1-silenced sections compared to the negative control, this form of treatment likely works to stimulate murine neuroregeneration. However, cells positive for Cas3 are initiating or undergoing apoptosis following treatment, indicating that the siRNA treatment may induce tissue cytotoxicity. Results from the BrdU and IHC experiments and the behavioural tests may further support the use of Prmt1 as a potential therapeutic target for VaD.

There are a few concerns pertaining to the upregulation of VEGF. The primary concern is VEGF's role in cancer, as VEGF is known to be overexpressed in various malignancies and its expression appears to be correlated with cancer progression (Costache et al., 2015; Luo et al., 2016). Moreover, targeting players that indirectly promote VEGF expression may not prove to be the optimal method of stimulating EC and neural cell outgrowth. With regards to this concern, direct overexpression of VEGF *in vivo* may be tested. This can be accomplished by widespread introduction of an AAV-VEGF vector through intrathalamic convection-enhanced delivery (Barua et al., 2013). If VEGF

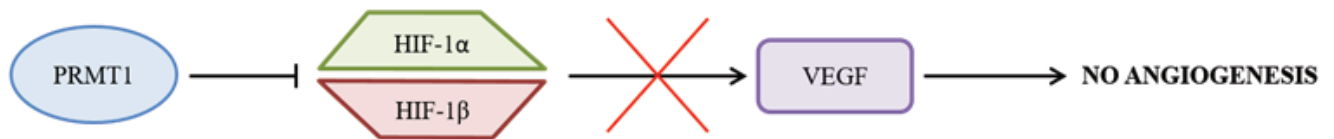
knockout studies are requested, VEGF floxed mice (C57BL/6) under the control of a tamoxifen-inducible Cre recombinase can be utilized (Gerber et al., 1999; Hayashi and McMahon, 2002). In addition to target expression challenges, BrdU labeling may be another experimental concern as (Lehner et al., 2011) proposed that BrdU incorporation represses neuronal and oligodendrial differentiation *in vitro*. This could potentially interfere with the visualization of any treatment-derived neural cell differentiation in this proposal. Lastly, additional studies such as a Morris Water Maze (MWM) test and the Rotarod test can be utilized to examine if spatial learning and memory deficits are suppressed by Prmt1 KD while still retaining cerebellar (motor coordination) function (Vorhees and Williams, 2006). The MWM test has some caveats, however. D'Hooge and De Deyn (2001) indicated that hippocampal neurons were damaged in response to ischemia (similar to BCCO-hypotension VaD model above), and claimed this may have been partially responsible for any observed MWM deficits. Another caveat of the MWM is that mice are also not the best swimmers (Whishaw, 1995). To account for these problems, alternate tests such as T-mazes can be utilized to assess memory, although T-mazes similarly have their own caveats. These include the inability to determine if rodents are using spatial or non-spatial cues to navigate their surroundings, or if experimenter involvement influences test subject behaviour (Shoji et al., 2012). The Rotarod performance test would enable experimenters to examine cerebellar function in the VaD model with and without treatment (Shiotsuki et al., 2010). This would provide more insight into emerging research indicating a link between cerebellar dysfunction and VaD (Sui and Zhang, 2012).

VaD is a progressive disease that results in cognitive impairment due to ischemic, hemorrhagic, or hypoperfusive events. No current treatment options exist although pre-existing therapies utilized to treat other conditions are being explored. In this proposal, PRMT1 was discussed as a previously identified protein involved in arginine methylation. Its role in Hif-1 and Vegf induction is also known. Characterizing Prmt1 KD *in vitro* and *in vivo* may benefit our understanding of ECs and angiogenesis in promoting nervous tissue regeneration follow-

ing ischemic or hemorrhagic brain damage. Given the current state of knowledge in DsiRNA delivery and tissue imaging studies, some neuroregenerative events may not be captured in the proposed experiments. Alternative methods of delivery and functional studies can also be employed to further improve our knowledge on the role of brain EC Vegf

induction and subsequent neural cell outgrowth. Ultimately, this is the only study proposed that examines Prmt1 KD as a potential therapeutic avenue to treat brain injury resulting from VaD progression. As a result, it will provide novel insight on the cryptic disease that is VaD.

Basal Cellular Conditions



DsiRNA knockdown of PRMT1

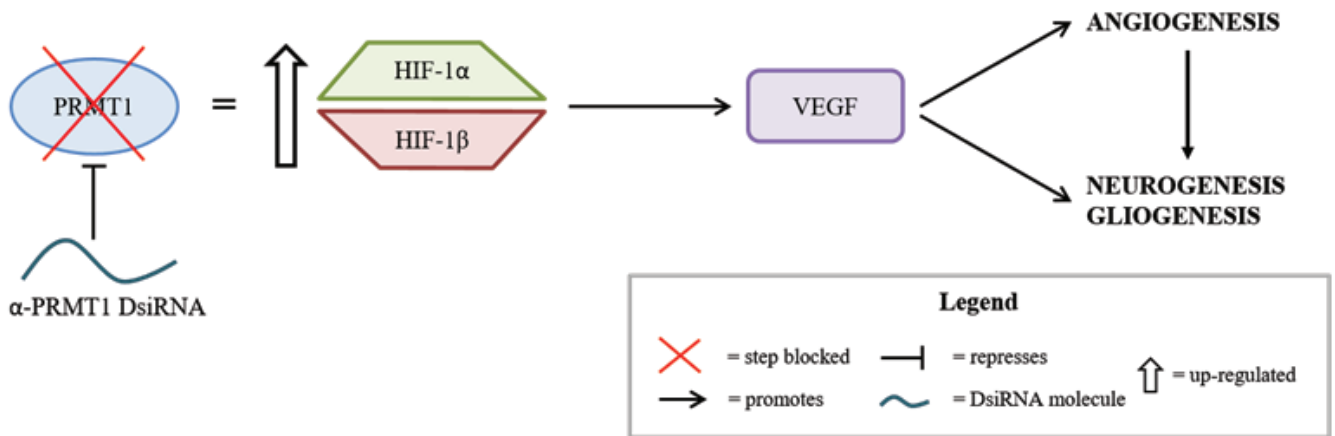


Fig. 1. Hypothesized therapeutic avenue for treating hypoxia-induced brain injury in Vascular Dementia patients. PRMT1 repression of VEGF inhibits aberrant angiogenesis and neural repair/regrowth under normoxic conditions (top frame). PRMT1 silencing (bottom frame) in brain endothelial cells may promote angiogenesis and neuro-/gliogenesis in patients suffering from hemorrhagic or ischemic events like those observed in Vascular Dementia. Both VEGF and angiogenesis may directly lead to neuroregenerative effects.

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