

Momenta

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On the cover

Thin sheets of ice exhibit spectacular, colourful birefringence when photographed through cross polarized filters. This effect is caused by the double refraction of light rays that travel at different speeds through the ice crystals depending on the orientation of the molecular structure.

Image Credit

Tom Wagner

momenta (n. pl.) Latin

1. The indwelling forces that are the principle of change.
2. The circumstances that precipitate change.

The papers in this volume are momenta in the sense

[ii] that they are reactions to a set of circumstances (the ideas, the work of understanding, the opportunity to consider those ideas), and also in the sense

[i] that they make contribution to ongoing scholarly discussions and so inevitably change the course of those discussions.

Translated by Darcy Otto, Professor of Philosophy and Classics at Quest University Canada

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FOREWORD

Editorial Board

The goal of *Momenta* is to provide an opportunity for students to further develop and showcase their best work. Without opportunities such as *Momenta*, our ideas, analyses, and insights—although well developed and thought provoking—sit on hard drives while we move on to new challenges. We are here to dig up these gems and present them to the community. True to our title, these papers do not intend to offer incontrovertible conclusions, but rather a depth of analysis that spurs our continually evolving understanding of complex ideas.

With much gratitude to last year's editorial board, we present to you the second installment of *Momenta*, *Quest Academic Journal*. This year, we solidified the procedure for the review process, transitioning from last year's fledgling method. We hope this established process will bring *Momenta* from a pilot project to an enduring part of the *Quest* community.

Without further ado: *Momenta*, volume 2, issue 1—the collective efforts of *Quest* University students, faculty and staff.

Sommer Harris
Daniel Herrmann
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Canadian Inaction on Climate Change

Evan Guy

Abstract

It is well understood that the potential impacts of climate change on future generations are catastrophic, and that these impacts will bring about social, economic, and political hardship. Economic decarbonization (i.e., using market mechanisms to reduce, and eventually cease, services and products that emit greenhouse gases) is widely viewed as the most cost effective long-term way of stabilizing the climate. However, the initial sunk costs associated with decarbonization are a common concern amongst Canadians, as potential losses are valued at upwards of CAD \$20 billion. The perceived political risks of burdening Canadians with these costs have resulted in short-term economic thinking that prevents Canada from addressing the intergenerational externality of climate change. The solutions to Canadian inaction must come from the synergy of bottom-up and top-down approaches. Bottom-up approaches come from the general public to pressure larger organizations such as governments to take action. Meanwhile, top-down approaches come from these larger organizations to pressure the general public to take action. Bottom-up responses specific to the climate crisis would need to become more prominent in order to demonstrate that Canadian citizens want to move towards decarbonization. Subsequently, top down subsidies for renewable energy sources and vulnerable industries must be implemented to ensure energy security and that sunk costs are accounted for throughout the process of decarbonization. This would likely be most effective in a province-by-province decarbonization scheme.

Preface

This paper is a response to an assignment prompting an assessment of the inaction of a certain group or institution in response to climate change. The assignment required this assessment to be based on the barriers of inaction postulated by Gifford (2011). Through this assignment I have developed an appreciation for the complexity of policymaking and the dynamics between the Canadian federal government and Canadian citizens. Most importantly, I have developed a greater understanding of the vast amount of difficulties associated with climate change and learned how to analyze the viability of possible ways forward. This paper is an important addition to existing literature because barriers that prevent action on climate change bind certain individuals, groups, and institutions differently. By understanding the barriers that are most

pertinent to certain individuals, groups or institutions we can attempt to most appropriately resolve them in order to promote action. Since responses to climate change rapidly evolve, it is important to note the time and context in which this paper was written. This paper was written just prior to the 2015 election of the Liberal Party and the Paris 2015 summit. Both events have influenced Canada's federal policy on climate change and thus would bear an impact on the contents of this paper.

Introduction

Anthropogenically-induced climate change is already affecting us. There is nearly unanimous agreement amongst scientists, governments, and even most in-

dustries about the imminent threat of climate change. We know that climate change will have devastating effects on our economies and lives. Yet, the actions Canada has made to mitigate these impacts have been negligible considering our comprehensive understanding of climate change. Gifford (2011) postulates that there are seven main barriers that can explain such inaction. They are limited cognition, ideologies, comparisons with others, sunk costs, discredence, perceived risks, and limited behavior. Of these seven barriers the two most prevalent in causing Canadian federal inaction are sunk costs and perceived risks. Sunk costs are expenditures that have already been incurred and cannot be recovered (Gifford, 2011). In the case of climate change, this refers to the costs already incurred on carbon-based products such as most cars. Meanwhile, perceived risks are the concerns associated with the uncertainty in the possible outcomes of acting on climate change. Ultimately, it is the combination of these two barriers that can explain Canada's inaction on climate change.

Most people look to globally collective top-down approaches to make impactful and aggregate action to solve the climate crisis (Mendelsohn, Morrison, Schlesinger & Andronova, 2000). After all, the role of a democratic government is to represent and promote the well-being and interests of its people, especially in response to such a crisis (Rueschemeyer, Stephens & Stephens, 1992). Many examples, such as the Great Depression, illustrate times in which federal governments have been faced with disaster and found solutions that actually improved the lives of its citizens. Climate change is different than any of those disasters. The Great Depression in many countries around the world was mostly solved with a series of calculated economic policies (Temin, 1991). They restored and ameliorated national standards of living by stimulating economic growth (Hamilton, 1987). Climate change cannot be easily solved by these normal economic policies since the externality of climate change (i.e., greenhouse gas emissions, most notably CO₂) is quite unique. In economics an externality is considered to be the cost of a behavior that affects a party who did not choose to incur that cost. Most externalities are relatively easy to solve by calculated taxation, subsidization or regulation (Arrow, 1970). However, with climate change's

externality there are “many jurisdictions, weak representation of those most affected (future generations), long-term horizons, a global scale, major uncertainties and important interactions with other market failures” (Stern, 2006, 293). This is an unprecedented problem since it demands ingenerational and international collective solutions (Stern, 2006).

For these reasons, the externality of climate change is not immediately tangible and thus does not influence behavior very easily. The division of the world into nation-states makes it very difficult to economically address the internationality of climate change's causes and impacts (Stern, 2007). We must therefore rely on individual countries like Canada to make policy that is separate in action yet globally collective in objective. However, every country has barriers to meeting these objectives that are unique to its developmental circumstance. As an historically industrial economy, Canada's barrier has been overcoming the sunk costs associated with decarbonization. Canada has seen five different prime ministers since the Intergovernmental Panel on Climate Change was founded, each of which has done little better than the next to play their part in solving the climate crisis. This has been due to the perceived risks of economic and social loss from ignoring these sunk costs (Gifford 2006). Most capitalistic systems are incongruent to solving problems that only show long-term benefits (Roberts & Emel, 1992). Canada is not an exception. Both the people and the governments of Canada have been delaying the inevitable. Of the many conundrums of climate change, the intergenerational barrier has been perhaps the most unprecedented and thus difficult for Canada to overcome.

Sunk Costs and Perceived Political Risks in Canada

How Invested in Carbon Are We?

Canada has been unable to make the short-term economic sacrifice it must make for long-term viability. Economic analyses have made it clear that costs of in-

action greatly outweigh the costs of action. Globally, it is estimated that a warming of 5°C could result in CAD \$7 trillion of losses while at least \$4.2 trillion of that is risk manageable by proactive mitigation (Stern, 2006). While Canada does not bear all of these costs directly, there would be massive ramifications on its trade (Reilly & Hohmann, 1993). So why is it an issue if we have more money to lose from inaction than action? The sunk costs associated with the infrastructural changes necessary to solve the climate crisis are too high. Canada's government, business, and individuals have too wide scale investments into energy, agriculture, construction, transportation, and many more green house gas emitting sources that would need to be lost in order for decarbonization to occur (Timmons, Harris & Roach, 2014). This is quite a significant initial economic hit and has been hard for Canadians and governments to come to terms with. Figure 10 shows the economic impacts of a decarbonization scenario on Canadian annual consumer and firm investments between 2015 and 2050. Consumers experience a cumulative drop in investment costs of CAD \$2.6 billion per year. This represents CAD \$2.6 billion dollars of lost economic freedom, since consumers will not be able to buy the cars, houses or even travel the way they

want to anymore. In a study where people were asked to rank the importance of climate change to other concerns, they assigned it as low importance (Leiserowitz, Kates, & Parris, 2005). Evidently, most Canadians will not be inclined to give up their trip to Hawaii for the sake of decarbonization. Meanwhile, in this scenario, there would be an annual investment increase of CAD \$16.2 billion dollars for firms. For example, the Empire State building, in New York, spent USD \$550 million on light bulbs, upgrading its energy efficiency. As seen in figure 1, there would be a necessary investment in electricity that is 89% greater than any historical annual investments. Such seemingly unnecessary investments would cut into firm profits resulting in lost income and lost jobs. Ultimately, decarbonization would have hugely negative immediate implications for the people and businesses of Canada.

What Are the Political Risks?

The perceived political risk of forcing consumers and producers to deal with sunk costs has been too high. Of Gifford's (2011) six perceived risks, the financial, functional, and temporal risks are the most applicable

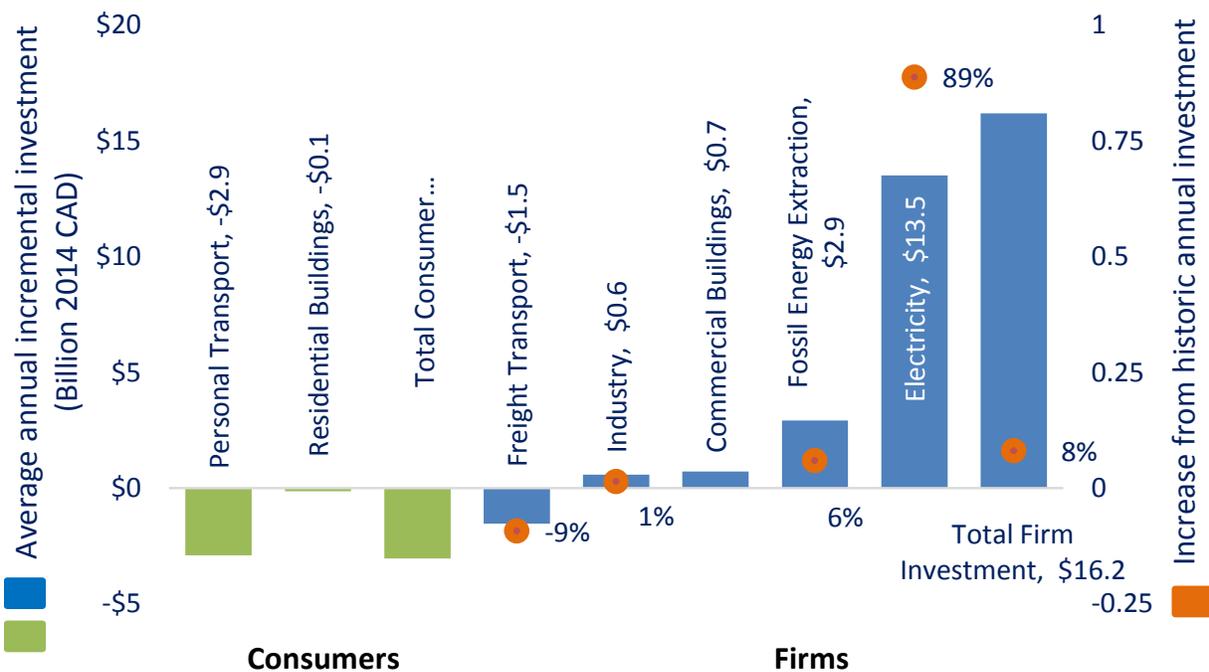


Figure 1. Shows the Change in Canadian Annual Investments
Source: Bataille, Sawyer & Melton, 2015

to Canada. These three risks on a federal level are concerned by the uncertainty of whether policy action will work, how well it will work, and how long will it take to work (Gifford, 2011). To present date, the impacts of climate change on Canada and future benefits of decarbonization have been too intangible for ignoring these sunk costs to be politically viable. Consequently, federal economic decision-making has shown a tendency to be shortsighted.

Canada's federal leaders are structurally constrained to be shortsighted in their policy. Canada's federal government is a parliamentary system. A parliamentary system differs from a presidential system because of the lack of separation of powers (Moe & Caldwell, 1994). In a parliamentary system a single leadership group holds both legislative and executive authority (Lijphart, 1984). On the other hand, a presidential system divides the authority of legislative and executive between two different authorities (Moe & Caldwell, 1994). The Charter of Rights and Freedoms limits the term a Member of Parliament, including the Prime Minister, can serve to five years before re-election. Furthermore, the charter also allows a Members of Parliament to have an unlimited amount of terms in office. By these conditions, federal leaders are incentivized to make short-term policy that shows prosperity just before their five years are over (Morton, 1987), since it would provide them with campaigning material for re-election. Also, since there are no term limits, there is no incentive to make impactful long-term change (Morton, 1987). If voters see that a leader has made progress they will typically re-elect them and if they see regression they will not (Morton, 1987). In the process of decarbonization, only the losses from sunk costs would be seen within this five-year period and would show economic regression on the part of the party that is in power (Morton, 1987). Voters would then opt for another party against decarbonization in order to restore economic progress, and all efforts to stabilize the climate would be lost. Since Members of Parliament of the party in power are driven by short cycles of re-election, a long-term policy such as decarbonization would be political suicide. Such a political constraint, in combination with the fact that the governing Prime Minister and members of their party have both legislative and executive powers, is a recipe

for federal inaction.

It is evident that Canada's political structure does not promote policy in which the benefits only occur in the future (Morton, 1987). In order for a federal government to be motivated to implement decarbonization, constitutional reform would need to occur. If federal government is to be motivated to deal with long-term issues, the periods in office must become longer and a limit on terms must be made. Amendments of the Charter of Rights and Freedoms that combine the term conditions of nations like Ireland or the United States would be more suitable. In Ireland the Members of Parliament are elected for seven years. A similar term would provide Canada's leaders with more time to implement decarbonization without only experiencing the losses from sunk costs. Meanwhile, in the US there is a two term presidential limit. A similar condition of terms would encourage Canadian policy to be impactful in the long-term rather than solely focusing on policy for re-election. Both the US and Ireland are annex I countries that have been able to make more impactful mitigative policy on climate change than Canada (Stern, 2007).

Discussion

Constitutional reform would help to solve the root issue that current top-down governmental approaches are shortsighted. However, it is somewhat unrealistic as it brings forth another set of political issues and would be hard to change through referendum (Sundquist, 1986). It is therefore hard to depend on the federal government to end the stalemate of Canadian inaction. Research has shown that substantial and widespread worry amongst the electorate in democracies is the driving force behind the long-term risk management policy that is necessary to combat climate change (Weber, 2006). Consequently, worried citizens must take the initiative to vocalize that they want decarbonization. The synergy between top-down and bottom-up approaches offer a climate change specific response to address the issue of sunk costs (B. Guy, personal communication, October 9, 2015). Canadian citizens must more widely and emphatically

express their willingness to ignore the sunk costs associated with decarbonization and put their shortsighted desires aside for the benefit of future generations. If this sentiment was popular enough the federal government could more comfortably shift its priority towards long-term prosperity over short-term gains. The federal government can help foster this collective mentality through educational programs. However, such programs that target moral frameworks would take time to come into effect and vulnerability costs (costs associated with damages caused by climate change) may become too significant by that point. Consequently, immediate economic decarbonization that is conscientious of those impacted is likely the best way forward.

The government can make decarbonization easier by protecting those most vulnerable (Metz, Davidson, Bosch, Dave & Meyer, 2007). Those most vulnerable are those with the highest sunk costs in carbon-based goods and services. Subsidization of renewable systems could help to ensure energy security whilst fossil fuel systems are dismantled. Fossil fuel prices are rising (MC_{fossil}) over time as they become scarcer, while, the price renewable energy sources ($MC_{\text{renewable}}$) are decreasing over time due to technological innovation (as seen in figure 2). Canada is currently at t_2 where it is dependent on fossil fuels because of lower prices (figure 1). It will not be until t_1 that renewable energy will be more cost effective and thus common than fossil fuels. The Canadian government can intervene to make this time gap shorter by subsidizing renewable energy and removing subsidies for fossil fuels. This would not incur any additional taxpayer losses since the subsidy is simply transferred between energy sources. How-

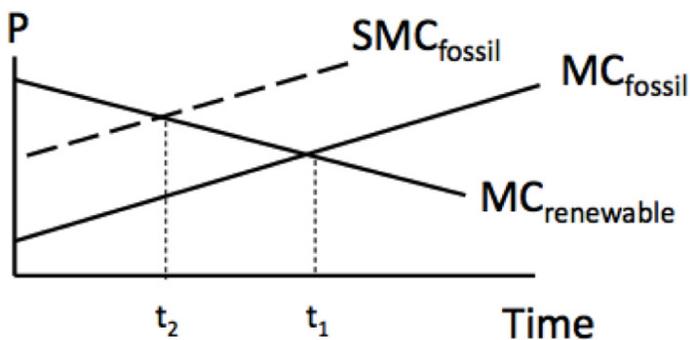


Figure 2. Shows the economic transition dynamics from fossil fuel to renewable energies ($P = \text{Price}$).

ever, energy prices would undergo a spike. Additional subsidization of industry that is vulnerable to such a spike could help prevent economic recession. However, all taxpaying citizens must be willing to shoulder the costs of those most economically vulnerable.

Given Canada's current state, it is highly idealistic to image a federal government that is not limited by the perceived risks associated with sunk costs, especially in regards to the oil sands. 22.1% of Alberta's GDP came from the oil and gas sector in 2012 (Alberta, 2015). Meanwhile, British Columbia is more progressive as it is mostly powered by hydroelectricity and has already started decarbonization by means of a provincial carbon tax (Pederson & Elgie, 2015). It is evident that a federal decarbonization scheme would not adequately account for the uniqueness of each province's sunk costs. Therefore, it could potentially be more productive to mandate a province-by-province decarbonization plan under the guidance of a nation-wide emissions cap. This would best protect those vulnerable and concerned about sunk costs.

Conclusion

Since the founding of the IPCC, there has been a stalemate of inaction between the Canadian public and government. This is mostly because the constitution of Canada restricts proactive top-down solutions to the unprecedentedly intergenerational externality of climate change. Since constitutional reforms to solve this issue are improbable it is hard to expect the federal government to catalyze Canada's decarbonization. Demands for decarbonization must come from Canadian citizens. Canadians on both individual and corporate levels have to be proactive and willing to shoulder the losses of sunk costs. The government can help these "economic losers" by subsidizing those most vulnerable. However, such policy again calls upon the majority of Canadian taxpayer's willingness to bear the costs of the subsidies. Ultimately, Canada's inaction must be solved by equal efforts on the part of both its citizens and federal government.

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The Woodward's Redevelopment & Intensified Metropolarities

Kendra Perrin

Abstract

This paper argues that the Woodward's redevelopment in Vancouver's Downtown East Side (DTES) represents an instance where a seemingly innocuous architectural project symbolically contributes to the gentrification of a neighbourhood. Further, the author argues that by including a social housing component and branding itself as a radical experiment in architectural inclusivity, the Woodward's redevelopment sought to disguise its role in socially and spatially polarizing the DTES. The author explains that the redevelopment of Woodward's from a department store into a stunning and imposing housing and retail complex transformed the "urban vernacular" of the DTES. Using basic semiotics to interpret Woodward's as a sign, she argues that the building, now a landscape of power, signifies that the DTES is no longer the neighbourhood of the poor; it has been conquered by the middle-class, whose aesthetic sensibilities now tower over it. The author asserts that part of Woodward's effectiveness as a divisive landscape lies in its ability to send different messages to different audiences. While a poor, marginalized resident of the DTES may read Woodward's as a giant 'STAY AWAY' sign, a middle-class architectural critic may see nothing of the sort. Borrowing from Caroline Mills, the author refers to this as the "cultural clothing" of gentrification. The author insists that there is an important distinction between genuine social mix and Woodward's charade of class co-existence in two separate towers.

"City planning and urban design are neither politically neutral nor socially indeterminate in their effects."

– John Rennie Short

Throughout much of the 20th century, the Woodward's department store was the economic core of Vancouver's Downtown East Side (Vancouver Sun). Taking up nearly an entire city block, Woodward's was a practical and affordable shopping destination for many of the working-class inhabitants of the formerly industrial area. However, the store went bankrupt in 1993 and sat vacant for over a decade before its redevelopment into a mixed-use residential and retail space began in 2006 (Gagnon). The redevelopment project was completed in 2010, and today the new Woodward's building, which includes a 43- and 32-storey tower, dominates the skyline of the Downtown East Side (hereinafter referred to as the DTES) (Longhurst, 6). Woodward's

sheer vertical scale is impressive, and the building imposes itself on the surrounding, far less ambitious architecture as the 'big guy,' setting the tone for the entire neighbourhood (see fig. 1 and 2).

In this paper I argue that the Woodward's redevelopment represents an instance where an ostensibly innocuous architectural project has led to the heightening of what Edward W. Soja calls 'metropolarities'—intensified economic inequalities and social polarizations in cities (Soja, 5). Furthermore, I argue that by including a social housing component and branding itself as a radical experiment in architectural inclusivity, the Woodward's redevelopment attempted to conceal the effect it would inevitably have on Vancouver's already severe socio-spatial stratification. I take a semiotic approach to analyzing the Woodward's redevelopment (as opposed to, for example, empirically analyzing its impact on homelessness), relying on Sharon Zukin's

theory of ‘landscapes of power’ and Mike Davis’ notion of ‘archisemiotics.’ I borrow from the basics of semiotics and interpret the Woodward’s redevelopment as a landscape (sign) in both the material (signifier) and symbolic (signified) sense. What concerns me most about projects like Woodward’s is their ability to aestheticize injustice and fetishize grit; ultimately, their ability to make the urban middle-class unaware of its complicity in gentrification¹. Through zooming in on this particular case study, I aim to expose in a broader sense how buildings can gentrify not only by displacing lower-class residents but also by symbolically altering the nature of a neighbourhood. Buildings like Woodward’s offer a clear, though unwritten, message of who does and does not belong in their vicinity.

In order to grasp just how significant a role the Woodward’s redevelopment plays in the ongoing gentrification of Vancouver’s DTES, some basic information about the neighbourhood is essential. The DTES lies

to the east of, but walking distance from, Vancouver’s financial district. In the second half of the 20th century, the DTES became Vancouver’s skid row, and it is now often referred to as “Canada’s poorest urban postal code” (Longhurst, 2). Sadly, the nickname is fairly accurate; the median annual household income in the DTES is \$13,691, compared to a median of \$47,299 for the rest of the city (The Canadian Press). It is the home of the marginalized, widely known for its struggles with homelessness, crime, addiction, mental illness, and sex work, among others (Gagnon). However, not even its markedly rough street life has made the DTES impervious to the re-investment of capital, and the steady influx of upscale (upscale relative to the purchasing power of the low-income residents) retail and food outlets has made it the epicenter of debates about gentrification in the city. For community activists and gentrification scholars alike, gentrification is a concrete reality in the DTES, not a speculation or a possibility (Longhurst, 4). The number of market



Figure 1. The Woodward’s redevelopment from the sky. Photograph. Vancouver. Westbank. Web. 11/03/16.



Figure 2. The Woodward’s redevelopment from the street. Matheson, Bob. 2014. Photograph. Arch Daily. Web. 11/03/16.

1. I would like to state early and clearly that I am a member of this urban middle-class, and that growing up in Vancouver I was—and still am—complicit in the gentrification of the DTES in myriad direct and indirect ways. That said, I do not believe that being embedded in a system should disqualify me from critiquing it, though I understand and respect that not all will share this view.

housing units continues to increase while the number of affordable housing stock declines, resulting in the displacement of low-income residents by the ‘gentry’² (Longhurst, 4).

Enter the Woodward’s redevelopment, described by George Henriquez, the managing partner of the project, as a chance to “share a portion of the wealth created in real estate development to support the greater good” (Gagnon). The project, a public-private partnership, consists of 530 market-rate and 200 non-market (social housing) residential units, in addition to retail, service and educational facilities (Gagnon). Thus, in Woodward’s, rich and poor Vancouverites are neighbours—albeit occupying separate towers and using separate entrances, the significance of which should not be overlooked³. When describing the project, Henriquez’s rhetoric verges on utopian: he talks about Woodward’s as an opportunity to create social change through architecture, stating, “I always say that, as a model, [Woodward’s is] perfect. If every project was inclusive, if every project was 40% social housing, it would be a beautiful world” (Gagnon). While Henriquez will understandably tout the merits of his own project, and while his project does indisputably provide subsidized housing for a significant number of low-income people, I now wish to interrogate the notion that simply housing the rich and poor next to one another constitutes radical inclusion, or that it even negates social *exclusion*.

In *Landscapes of Power: From Detroit to Disneyland*, Sharon Zukin explains how gentrification can transform the “social meaning” of a downtown (Zukin, 197). She suggests that the physical structures constituting a downtown collectively form an “urban vernacular,” which can be read, or interpreted, by anyone.⁴ The investment of both state and private capital into redeveloping the abandoned department store, an iconic part of the DTES’ vernacular, transformed Woodward’s into a landscape of power that carries an

entirely new social meaning. Urban planners often hail this kind of transformation as successful ‘revitalization’ or ‘regeneration.’ A far less optimistic and more appropriate response would be reading Woodward’s as a landscape of power—of class power, in particular—for it acknowledges the divisive symbolism of such a development in such a neighbourhood. Paraphrasing the geographer Don Mitchell, Andrew Longhurst asserts that “landscapes are a work and they do work” (5). Mitchell claims that landscapes ‘are works’ because they have a physical structure, and that landscapes ‘do work’ symbolically: “Landscapes can symbolically reinforce the ideas of the ruling class, as part of an ideological framework ... to make middle-class claims to urban space” (Longhurst, 5). Thus, I interpret the Woodward’s project as the conquering flag of the new urban middle-class, strategically placed on the edge of the DTES. The flag visually establishes the middle-class’ claim to the territory, which, following some pioneering gentrification, is now desirable to its aesthetic sensibilities. But the flag is not a flag, of course: it is a towering concrete and steel structure, not just a symbol of ownership but also, as Zukin captures, a symbol of power.

Part of the new Woodward’s effectiveness as a divisive landscape of power lies in its ability to look, at least to some, like the exact opposite. The building largely obscures its hard-to-quantify gentrifying effects with its seductive, utopian brand of class co-existence and architectural inclusivity. ‘How can a project that is *housing* the homeless possibly be *excluding* the homeless?’ one might ask. But we must not be fooled. Woodward’s symbolic suggestions are as significant as any quantifiable effect, positive or negative, it has on the housing situation in the DTES. It is a conspicuous symbol that the neighbourhood is no longer a space for the poor, even if they are still permitted to live there. This is a difficult argument to make, for it requires that one tries to imagine what such a landscape might insinuate to a poor resident of the DTES. For people of relative privi-

2. ‘Gentrification’ has its etymological roots in the word *gentry*, which comes from *gentlerise*, an Old French word translating to something like “of gentle birth.” It was first coined in 1964 by the British sociologist Ruth Glass, who used it to describe the influx of middle-class people displacing lower-class worker residents in working-class neighborhoods of London.

3. Woodward’s is by no means the first mixed-income residence to create separate entrances for the owners of market and non-market units. Critics of the separate entrances in a divisive mixed housing project in Manhattan called this architectural ‘solution’ to economic integration the “poor door” (Bellafante).

4. The idea of a readable, urban vernacular can fruitfully be applied to Woodward’s, as Andrew Longhurst does brilliantly in his paper “Aestheticization and Consumption in Advanced Capitalism: The Woodward’s Redevelopment as a Landscape of Class Power.”

lege, this can be an imaginative stretch⁵. Herein lies the potency of stratifying through what Mike Davis calls archisemiotics: it is easy to say that you are not. In *City of Quartz: Excavating the Future in Los Angeles*, Davis powerfully elaborates this exact phenomenon:

Today's upscale, pseudo-public spaces—sumptuary malls, office centers, culture acropolises, and so on—are full of visible signs warning off the underclass 'Other'. Although architectural critics are usually oblivious to how the built environment contributes to segregation, pariah groups—whether poor Latino families, young Black men, or elderly homeless white females—read the meaning immediately. (324)

Thus, while it would be hard to convince the “pariah groups” that Woodward's *is not* full of “visible signs warning off the underclass 'Other'” (themselves), the pariah groups' opinions tend to have far less influence on dominant discourses than those of architectural critics, even those of members of the middle-class. With Woodward's and similar landscapes, those who are meant to get the message of exclusion get it, and everyone else either gets it and plays dumb or does not get it at all. My suspicion is that that most folks, less perspicacious than Davis, fall into the latter category.

Fundamental to Davis' theory of archisemiotics is that different people will receive different messages from the same built environment. In his analysis of Woodward's, Longhurst uses of the notion of 'visuality', which he describes as a “socially constructed way of seeing, which is different from vision, a biological function” (3). The notion of visuality provides a useful frame for Davis' archisemiotics, for it captures that, since the *signified* of a building (the message that its architecture suggests) is socially constructed, the 'way of seeing' will vary depending on the social, cultural, and economic context of the observer. Like with the linguistic sign, the relationship between the 'archi-signifier' and the 'archi-signified' is arbitrary—socially constructed rather than intrinsic. This explains why a homeless resident of the DTES might read Woodward's

as a giant 'STAY AWAY' sign while a middle-class architectural enthusiast could look at the structure and see nothing of the sort. Different visuality, different signified. What concerns me is that the flexibility of visualities allows for what Caroline Mills calls the “cultural clothing” of gentrification (Longhurst, 5). Essentially, by appealing to middle-class aesthetic sensibilities and cultural preferences, architectural projects like the Woodward's redevelopment can conceal, or clothe, the damage they inflict through gentrifying. By signifying 'authentic,' 'tasteful,' and 'historical' to the middle-class, the Woodward's redevelopment disguises its 'STAY AWAY' message. It packages social polarization and capitalist power relations so beautifully that many cannot help but ignore what is inside the package.

The Woodward's redevelopment alone is not responsible for the blatant socioeconomic inequalities that socially and spatially divide the DTES from the rest of Vancouver. These inequalities date back to long before the project was conceived, and the reasons for them are intractably complex. Woodward's has, however, made an explicit display of them. We now have a middle-class playground, what Longhurst calls a “hyper-aestheticized landscape of consumption” (10), immediately juxtaposed with the poorest urban postal code in Canada. One stroll through the area and you cannot miss the contrast. The Woodward's redevelopment symbolically suggests what the DTES ought to look like, thus establishing middle-class power and control of the neighbourhood (Longhurst, 7). Only four years after the project's completion, Woodward's market-rate condos are already worth hundreds and thousands of dollars more than what they were originally purchased for (Gagnon). This is a clear, empirical indication of the changing climate of the DTES. The monetary success of Woodward's has created gentrifying momentum and, unsurprisingly, we are now seeing plenty of other middle-class-catered developments emerging in the “profit-rich environment created in Woodward's wake” (Gagnon).

The gentrification scholar Neil Smith argues that gentrification is a global urban neoliberal strategy that seeks to establish the power of the wealthy in cities

5. As a person of relative privilege this is for me, too, an imaginative stretch. Further qualitative research would help better inform critical geographers' notions of what buildings like Woodward's signify to the poor, enabling our work to include the voices of the people that too often we write on behalf of without consulting.

(Longhurst, 3). I agree. We must not uncritically accept Woodward's claim that it is a model for socially responsible development. There is an important difference between genuine social mix—integration and solidarity between classes and races—and this charade of co-existing in two separate towers. As many wiser thinkers have said before me, distance is as much social as it is geographical.

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Characterizing the Immune Response to *Mycobacterium Tuberculosis*

Sarah Colpitts

Abstract

Tuberculosis (TB) is one of the most harmful and life-threatening diseases in the world. It infects roughly one third of the population, but is only pathogenic in about 10% of those infected. Nevertheless, the disease is a major challenge to modern medicine, as it is difficult to treat, and the vaccine is not 100% effective. The immune response to the tuberculosis causing bacteria, *Mycobacterium tuberculosis* (Mtb), is characterized primarily by an initial innate response signaled by infection in alveolar macrophages. Antigen-presenting cells then signal the adaptive immune response, which further activates macrophages required to kill the bacteria. Macrophages have a complex, multi-step method for fighting off the bacteria. The defensive mechanisms used by macrophages include the use of nitric oxide & reactive oxygen species, acidification of the phagolysosome and activation of the macrophage. However, Mtb has also evolved with many strategies to evade the immune host response including stopping the maturation of macrophage, which has immunosuppressive effects. Further research into tuberculosis will focus on narrowing down the exact mechanisms of infection to use as targets for accurate vaccine design and effective treatment.

Introduction

Tuberculosis, caused by the microorganism *Mycobacterium tuberculosis* (Mtb), is one of the world's deadliest diseases. In 2014, 9.6 million people became infected with Mtb and an astounding 1.5 million people died from the disease (1). While the number of people who became ill with Mtb is large, it is actually estimated that roughly one third of the world's population is infected with TB (1). The bacterium, however, is usually latent, with about 10% of individuals actually developing the active form of TB (2). Transmission occurs via aerosols, caused when a person infected with Mtb coughs, sneezes, or spits, and propels the bacteria through the air (1, 3). Those that are most susceptible are immunocompromised individuals, such as those with HIV or malnutrition or those who use tobacco (1, 2).

Mycobacterium are a class of bacteria that can be es-

pecially challenging to treat, even with no suppression of the immune system. The structure of their cell wall makes them unique, as they are not gram positive nor negative. They are therefore naturally resistant to many antibiotics, as many target the cell wall (3). One of the most important aspects of the cell wall in mycobacterium is the mycolic acid that is attached to arabinogalactan, which is then attached to peptidoglycan. The mycolic acid provides a lipid barrier that is responsible for many of the physiological and disease-inducing symptoms of Mtb (3). These symptoms may include, but are not limited to coughing up blood and flu-like symptoms (1).

Studying the immune response to Mtb is critical, as we are in need of new vaccines and there are many challenges in treating the disease. Currently, the only available vaccine, Bacillus Calmette-Guerin (BCG), is used for immunization of children in areas with a high Mtb presence, but offers no protection for adults, as adults

are affected by a different form of the disease (4). One of the reasons why more vaccines have not been developed is the lack of understanding of the immune evasion strategies elicited by Mtb (5). Further, after administering the vaccine, it can interfere with the accuracy of testing for TB through skin tests, as it can give off a false positive (6). To prevent the spread of the disease, immunization as a child is recommended, but only if the child will be in close contact with others who have the disease. Children living in a low incidence area, however, are not recommended to get vaccinated, as the vaccine is not 100% effective and can provide barriers to accurately test for TB (6). General practices of hand-washing and sanitization in hospitals will reduce the transmission of the bacterium. If infection does occur, there are a number of antibiotics, such as isoniazid and rifampin, that will be prescribed for a duration of 6 to 9 months. With proper treatment, absence of the multi-drug resistant strain, and an individual who does not have a suppressed immune response, full recovery should be possible (1).

Currently, there are few tests that accurately diagnose TB. There is a skin test, which is performed by injecting a small amount of tuberculin into the skin. The patient then returns to the testing site within 48 hours to look for a reaction. If the skin is inflamed, it is a positive result (6). There is also a blood test known as IFN- γ assays, to see how strongly a person reacts to the TB bacteria in the laboratory (6). Unfortunately, both of the tests cannot differentiate from latent or disease-causing TB. However, when flu-like symptoms are lasting, it becomes obvious that the disease is in its active form.

This review will first cover the initial innate immune response, which is required to recruit many of the immune cells for early control. Then, the paper will briefly discuss the role of dendritic cells and neutrophils in the response. Macrophages are then focused on in more depth as the primary mode of infection from Tuberculosis takes place within macrophages and therefore they play a major role in the defense. The bacterium has also developed many ways in which it evades the host immune system defenses, which is reviewed next in the paper. The adaptive immune response strategy is then covered and lastly the difficulties of vaccina-

tion design in order to prevent the disease, with future directions for research mentioned in the concluding paragraph.

Innate Immune Response

The innate immune response serves as the second line of defense against Mtb, with the first being the mucus lining of the respiratory tract and the epithelial layer. The primary target for Mtb is the lung tissue cells, although it can travel to other areas of the body such as the brain, spleen and liver (2). The primary event that initiates the innate immune response is infected alveolar macrophages secreting IL-8, which attract neutrophils, dendritic cells, and more macrophages (8). The innate immune system recognizes foreign molecules through Toll-like receptors (TLRs), which bind to epitopes on the surface of the bacteria known as pathogen-associated molecular patterns (PAMPs) (4). The initial innate immune response is less specific as it releases cytokines and lipids to activate other immune cells, which work to phagocytize the bacterium, and activate apoptosis. If the infection is not cleared by the innate immune response initially, the adaptive immune response is activated by antigen presenting cells (APCs), such as dendritic cells and macrophages.

Dendritic Cells

Dendritic cells are known to be the most important cell in initiating a response from T cells, which are necessary for the adaptive immune response to become activated (5). Although Mtb predominantly resides in macrophages, it has been shown to infect dendritic cells (DCs) as well (5). Most of the mechanisms that enable the dendritic cells to provide protection during an infection by Mtb are unclear, however it is known that they transport Mtb from the lungs to the lymph nodes to be destroyed (5).

Neutrophils

If infection occurs, neutrophils will also be targeted although these cells have not developed an effective

defense strategy. In patients with active Mtb, the production of the chemokine IL-8, released from infected macrophages, causes an influx of neutrophils into the lung (7). With an influx of neutrophils in the lung, the mycobacteria are also able to infect neutrophils and replicate rapidly within the cells (7). With a similar mechanism to macrophage protection, which will be discussed below, neutrophils initiate their antimicrobial effects after phagocytosis. Unlike macrophages, it has been shown that neutrophils cannot kill the bacteria. This has been proven by high levels of infected neutrophils that were not able to clear the bacteria in patients infected with TB (8). One study primed the neutrophils with pro-inflammatory cytokines, IFN- γ and TNF- α to enhance oxidative killing, yet to no avail, the priming had no effect and the neutrophils were not able to kill Mtb (9).

Macrophages

One of the primary cells to target Mtb upon infection are alveolar macrophages, which reside in the lung. They have evolved to elicit many defense responses to combat infections with bacteria such as Mtb. Macrophages first bind to the surface patterns of the pathogen through surface receptors such as C-type lectins, scavenger receptors, complement receptors, and mannose receptors (10). These receptors then signal production of pro-inflammatory cytokines, such as IL-1, to be secreted (11). Non-cell associated molecules of the humoral host defense such as surfactant proteins, the mannose-binding lectin, and complement components, are able to recognize and mark the bacterial surface, therefore facilitating the opsonization of the pathogen (12). Once engulfed in the phagosome inside of the macrophage after phagocytosis, the phagosome matures by a process of continuous fusion and fission events. These fusion and fission events acidify the phagosomal capsule by ATPase (13). A low pH is optimal for enzymatic activity inside of the phagolysosome, which kills the bacteria. The activation of toxic-antimicrobial effectors such as nitric oxide and reactive oxygen intermediates are also secreted with the production of IFN- γ . IFN- γ is then stimulated by Th1 cells after the antigen has been presented in the lymph. The reactive oxygen species and nitric

oxide can cross the phagosomal membrane to spontaneously react in the phagosomal lumen, where the bacteria are being housed. This process produces nitrogen peroxide and other bacteria-killing compounds (14). The IFN- γ and Th1 cells enhance the secretion of TNF- α , a pro-inflammatory cytokine, which works to activate the antimicrobial activities of the macrophage. The activated macrophages can limit the growth of intracellular bacteria and drive the maturation of the phagosome towards phagolysosomes (14). During the acidification process, the bacterial vacuole releases IL-12, which then further stimulates the Th1 and IFN- γ . This process is described as a positive feedback loop (20). The macrophage, once stimulated by IFN- γ , will also increase the expression of antigen-presenting and co-stimulating molecules like MHC-I, MHC-II, and TNF- α required for further T & B cell activation (9).

Mycobacterium Defense Against Macrophages

Just like the macrophage, the bacteria have also evolved to elicit a variety of defenses to infect the host cells. This is a classic example of the Red Queen hypothesis, where each organism has evolved to continually evade the defense mechanisms of the other. One of the mechanisms through which the bacteria can sustain the infection is to maintain a bacterial community inside of the phagocytic vacuole of the macrophage (15). The Mtb cells are able to inhibit the maturation of the macrophage and the acidification by the lysosome. It was shown in a study by Sturgill-Koszycki that the mycobacterium vacuoles acquire the lysosomal membrane protein, LAMP-1, but not the vesicular proton adenosine triphosphatase (ATPase), which is inherent in the process of phagosomal acidification (15). Therefore, they stop their fusion with the lysosomes. The mechanism through which the bacteria is able to do so is unknown, however the two hypotheses that have been put forth suggest that it is through either the selective inhibition of fusion with ATPase containing vesicles or a rapid removal of the complex from the phagosomes (15).

One of the consequences of infection in the macrophages is a delayed stimulation of the adaptive immune response as it induces the host expression of

anti-inflammatory cytokines (16). In a study done by Vanheyningen, the infected macrophages produced up to 10,000-fold more IL-6 than the uninfected macrophages (16). The levels of IL-6 may contribute to immune unresponsiveness apparent in humans, as it can act as both pro-inflammatory and anti-inflammatory (18). However, another study done on Mtb infected macrophages found that they produced high levels of TNF- α , IL-8, IL-6, IL-10 and IL-18. The release of IL-6 in the second study was hypothesized to not be a large contributor to the immune unresponsiveness. Instead, it was suggested to be a pivotal pro inflammatory cytokine that enhances innate immunity and specific CD4⁺ Th1 immune responses and is very important in the immune response to mycobacteria (17). This study also found that Mtb infected macrophages secreted IL-10, which is an immunosuppressive cytokine (17). Although the two studies report different reasons for immune suppression during infection of the macrophages, studies on the pro and anti inflammatory effects of IL-6 gave insight. The cytokine IL-6 has been shown to inhibit TNF- α and IL-1 when secreted in conjunction with the two, and therefore inhibits the activation of IFN- γ , an important part of stimulating macrophages to kill Mtb (18). It is with these immune evasion techniques, that the bacterium can be so successful in causing disease. As it can alter the secretion of important cytokines, which stimulate an immune response, it can successfully cause disease before the immune system has had a chance to fight it off.

Stimulating the Adaptive Immune Response for Release of Th1 Cells Required for Activation

The adaptive immune response has a prolonged response as Mtb stimulate inhibitory signals. As the immune system is so connected, it is impossible to separate the innate from the adaptive immune system. Therefore, aspects of the adaptive immune system have already been mentioned, such as activation of macrophages by Th1 cells. It is important to mention, that activation of the adaptive immune system with Mtb typically takes longer than with other pathogens such as *Salmonella* or *Plasmodium* (20). This delay has been linked to the bacterium causing an inhibitory signal-

ing cascade, not allowing CD4⁺ T cells to be stimulated (20). This mechanism of delay could be an important factor in the amount of latent Mtb, as the bacteria wait until they can accumulate sufficient numbers to completely evade the immune response (20).

Upon phagocytosis, macrophages and other phagocytes, such as dendritic cells and neutrophils, carry the engulfed bacteria away from the lungs and towards the lymph nodes. Once in the lymph, antigens are presented to T cells on the surface of the DCs and macrophages to initiate specific cellular immunity and generate specific T cells (19). Once activated, T cells undergo clonal expansion, differentiate into CD4⁺ effector cells and migrate towards the site of infection (21). As discussed previously, once at the site of infection, T cells recognise bacterial antigens on the macrophages and DCs and release IFN- γ to activate them (20). At the site of infection dying macrophages attract monocytes, which differentiate into healthy macrophages, and other immune cells leading to inflammation and formation of a local lesion. The whole process involves the release of TNF- α and results in the secretion of chemokines as well as the up-regulation of chemokine receptors.

Although the mechanism is unclear, antibodies are also thought to play an important role in activating macrophages. In studies done in vitro and in mice, monoclonal antibodies had significant protective effects that lead to a greater chance of survival, enhanced granuloma formation, and growth inhibition (21). Nevertheless, it is irrefutable that the adaptive immune system is needed to fully activate macrophages to kill intracellular *Mycobacteria* (21).

Difficulties & Strategies in Designing a New TB Vaccine

There are a number of difficulties in designing an effective vaccine for TB, which is generally characterized by the cellular immune response. The current vaccine is only a viable option for children and works primarily against the meningeal form, but not the pulmonary form most commonly found in adults (22). The main issue in designing an effective vaccine for TB is

the general lack of knowledge of how protective immunity is acquired and how the host defense is generated (22). In addition, there are not clear biomarkers of protection that allow researchers to target a specific immune response to elicit (4). Without these biomarkers, researchers have to go through long and costly clinical trials on humans, which is a significant financial burden on drug companies (22). The new vaccine developments are based on two different methods: 1) improving the current BCG vaccination, and 2) to attenuate Mtb (22). Both strategies have the potential to be effective methods, if they produce long-term immunity.

Conclusion

The immune response to TB is a complicated cascade, as with almost all immune reactions. The innate immune defense in response to *Mycobacterium tuberculosis* is arguably the most important player in the battle. If the bacterium succeeds in a long-term infection of the macrophages, then they will cause disease. This is why this review focused on the macrophage defense and bacterial immune evasion strategies in the most detail. The defensive strategies used by the bacterium and host immune system evolved together to make both the immune system so effective and the bacterium so infectious. Although there are times when one or the other wins, the mycobacteria have had such powerful immune evasion strategies, that if the immune system is compromised in the slightest it will take advantage. Moving forward in studying the immune response to tuberculosis, it is important that we continue looking at the specific strategies used by our immune system to evade the diseases. By studying these responses, we can understand which responses are most important in the evasion strategies and use immunotherapies to either enhance or mimic them, stopping the bacteria from causing infection. One way in which this would be accomplished, is through vaccination design, which would enhance our already powerful immune system. If the system by which we evade the adverse effects of tuberculosis is understood, optimization of our therapies to generate those that are effective across all populations can take place. Therefore, by characterizing and

understanding the immune response to tuberculosis, we are working towards eradicating the disease so that those vulnerable to the disease will never become infected.

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Expect and Predict Irrationality: Adapting the standard consumer choice model to explain irrational behavior by the character David in Charles Dickens's David Copperfield¹.

Jordan Larson

With only a few assumptions about rationality, consumer theory, a mainstream economic model of behaviour, allows us to understand and even predict human choices (Perloff, 2009, p. 76). However, the field of behavioural economics has shown empirically that these assumptions should not be so easily or quickly accepted. Standard models fail to incorporate emotional factors of decision-making, which often motivate behaviours that depart from rationality (Kahneman, 2011, p.12). Of interest in this paper is the emotion of regret, which is regularly involved in decision-making but neither explained nor incorporated in consumer theory (Kahneman, 2011, p.279). By examining the decisions of the character David in Charles Dickens's *David Copperfield* as a fictional case study representative of actual human behaviour, we find additional evidence that behaviours are often irrational and cannot be predicted or accounted for by the standard consumer choice model. In this paper we will analyze David's preferences between gaining respect for altruistic behaviour or for manly status-seeking behaviour, and we will see that his preferences are artificially changed by social standards influencing his choices. Due to the specific social setting, David makes a natural choice that appears to reduce, rather than maximize, his utility, which violates the standard model assumption of utility maximization. To explain his behaviour we adapt the consumer choice model to

incorporate David's preferences with respect to regret.

To contextualize this analysis we must first outline the foundations of the standard consumer choice model, which is built on utility theory. Utility is a measure of the level of a person's satisfaction, and is usually described with the following generic function: $U = f(x, y)$ where the inputs "x" and "y" are the levels or amounts of goods, services or choices that can provide utility in a given scenario (Goolsbee, Levitt, & Syverson, 2013, p.114). Holding all other goods constant and only examining two inputs allows us to graphically analyze preferences with the consumer choice model². The model graphically depicts a consumer's preferences for the inputs of their utility function, with the quantity of one good/service placed on the y-axis and the quantity of the other placed on the x-axis. The preferences are depicted as a line called an indifference curve, where every point on the curve, representing different amounts/levels of the two goods/services, results in an equal amount of utility. An indifference curve is convex to account for a diminishing marginal rate of substitution³ (Goolsbee *et. al.*, 2013, p.120). Given the standard assumption of non-satiation⁴, curves that sit farther from the origin represent higher utility (See figure 1 below, U1, U2, U3). Additionally, four axioms of utility theory are required for a continuous utility function to exist; these axioms also ensure that indif-

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1. This paper was written for a behavioral economics course. For this assignment students were asked to read a novel, which represents an extended case study of human behaviors in realistic scenarios, and search for, as well as adapt the consumer choice model to explain, irrational decision-making of the characters.
 2. More advanced utility function and preference analysis is also done for utility functions with more than two inputs, but undergraduate microeconomics texts generally hold all but two goods constant to assist with graphical analysis.
 3. In simple terms, diminishing marginal rate of substitution means that if you have increasing amounts of good "x" relative to good "y", you are willing to give up increasing amounts of good "x" to get an additional unit of good "y".
 4. This is an assumption that more is better (Katz & Rosen, 1998, p.24).

ference curves do not cross⁵. Finally, consumers are assumed to make decisions that maximize their utility, and choices are assumed to be consistent⁵ (Katz & Rosen, 1998, p.24).

Since consumption cannot be infinite, it is constrained in the model by a budget line that describes the entire set of consumption combinations a consumer can purchase when spending their entire budget for those items (Goolsbee *et. al.*, 2013, p.134). Under the assumptions of the model listed above, utility is maximized at the point where the indifference curve is tangent to the budget line. Thus, only the combination of goods at that point maximizes a particular consumer's utility in a given scenario (see figure 1 point A). Changes in the costs of the goods consumed rotate the budget line⁶ (see figure 2 BL1 and BL2 below, where the cost of good "x" decreases, rotating the BL outward along the x-axis).

While the consumer choice model is often presented in undergraduate microeconomics textbooks as a way to examine purchasing options available to consumers, it can also be conceptually applied to many choice scenarios involving decisions between two options⁷. Below, the model is applied to David Copperfield's choices, and we see that the model fails to predict his

behaviour under what initially appears to be irrational decision-making. In the following analysis we will be examining David's preferences between gaining respect from altruistic behaviour, which is his natural tendency, and from manly status-setting behaviour, which David experiences as the social standard (See figure 3 below, where respect for altruistic behaviour (r_A) is plotted on the y-axis, and respect for manly status setting behaviour (r_M) is plotted on the x-axis).

When he is a child and a young boy, David displays a natural tendency toward acts of kindness and altruism. An example of this is when David offers, but is sweetly rejected, what little money he earns to the Micawbers during their severe financial troubles. " 'No, my dear Master Copperfield,' said she, 'far be it from my thoughts! But you have a discretion beyond your years, and can render me another kind of service, if you will; and a service I will thankfully accept of,' " (Dickens, 1850, chapter XI). David eagerly accepted: "I understood Mrs. Micawber now, and begged her to make use of me to any extent," (Dickens, 1850, Chapter XI). While young and poor, David does not have the ability to gain respect from manly status-setting behaviour, so his budget line extends straight down along the y-axis (see figure 3, BL1). However, as he gets older and his income and connections increase,

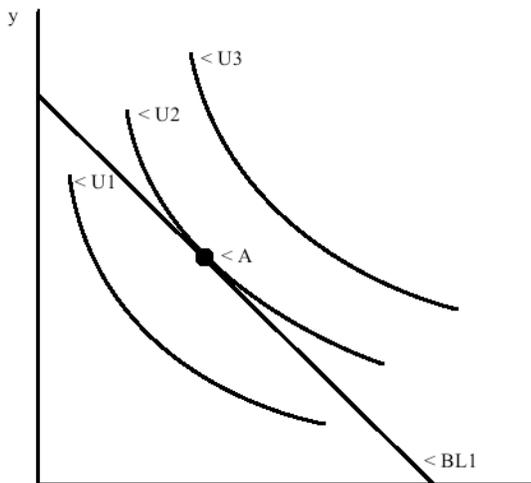


Figure 1.

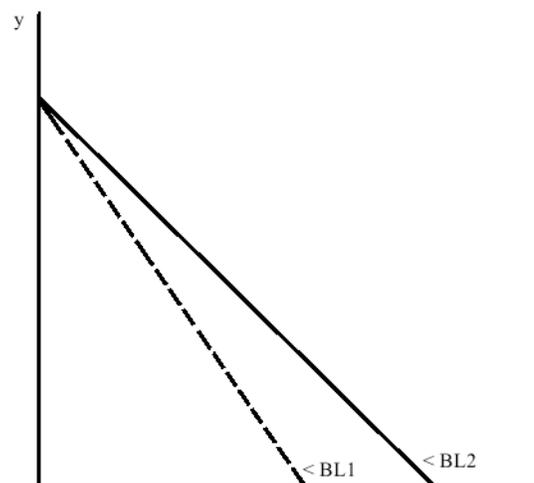


Figure 2.

5. The axioms required are continuity, reflexivity, completeness, and transitivity. (Transitivity requires that if one combination "A" is preferred to combination "B", and combination "B" is preferred to combination "C", then "A" is preferred to "C", leading to consistency.) See Varian (1992) for additional information and explanation.

6. This means that as the price of a good decreases, with an unchanged budget, a consumer can purchase a higher quantity of that good.

7. Regardless of the presence of a market price or specific monetary budget, many decisions involve preferences and some limitation in the availability of choices and their combinations. Thus, the model can be conceptually applied to choice under constraints, despite the fact that the quantitative aspect of the analysis may be lacking.

his budget line rotates accounting for more opportunity to gain respect from manly status-setting behaviour (see figure 3, BL2, BL3).

After David has matured and acquired a decently large sum of money while staying with his aunt, he makes the decision to act like a man and demand respect for his status from a coachman. “The main objective in my mind, I remember, when we got fairly on the road, was to appear as old as possible to the coachman, and to speak extremely gruff.” (Dickens, 1850, chapter XIX). But David did not make this decision because it was his natural preference; in reality it made him uncomfortable. Instead, he made it because it seemed like the appropriate thing to do. “The latter point [of speaking

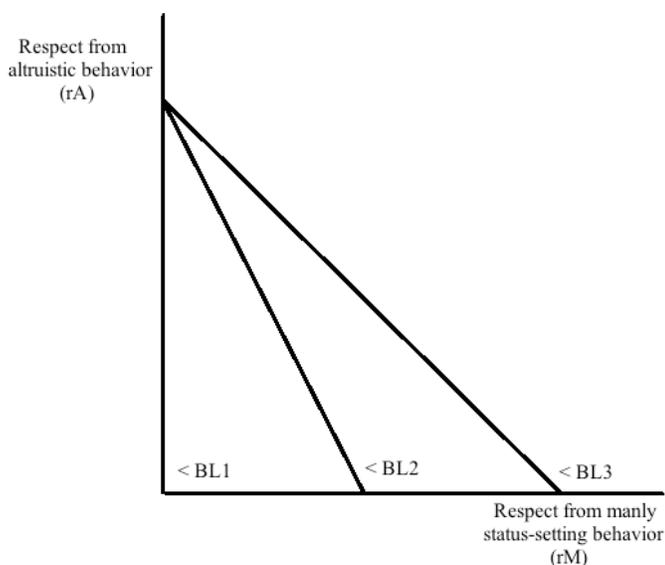


Figure 3.

gruff] I achieved at great personal inconvenience; but I stuck to it because I felt it was a grown-up sort of thing.” (Dickens, 1850, Chapter XIX). With this decision to demand respect for his status, David establishes his indifference curve closer to the x-axis (see figure 4, U1). Thus, despite the decision causing a certain level of discomfort, he still prefers it to the alternative of acting outside what he believes the social standard to be. However, when the coachman suggests David give up his nice coach-box seat to an older, but less educated, man behind him, David makes the decision natural to his character and gives it up. “... I blushinglly offered to resign it.” (Dickens, 1850, XIX). The kind act of giving up his seat falls closer to the y-axis (see figure 4 point B), and lies on a lower indifference curve (see figure 4,

U1 to U2). This decision lowers David’s utility, which violates the standard assumption of utility maximization. The loss of utility is not only assumed because it is graphically represented as such; David feels and explicitly comments on the loss. “I have always considered this as the first fall I had in my life.” (Dickens, 1850, chapter XIX).

The evidence of David easily giving up his seat and his reason for trying to act gruff in the first place suggests that his figure 4 U1 indifference curve is not actually representative of what gives him true satisfaction. Instead, it is representative of what he thinks his indifference curve *ought to be*, and behaving otherwise causes an experience of lower utility. This example shows that

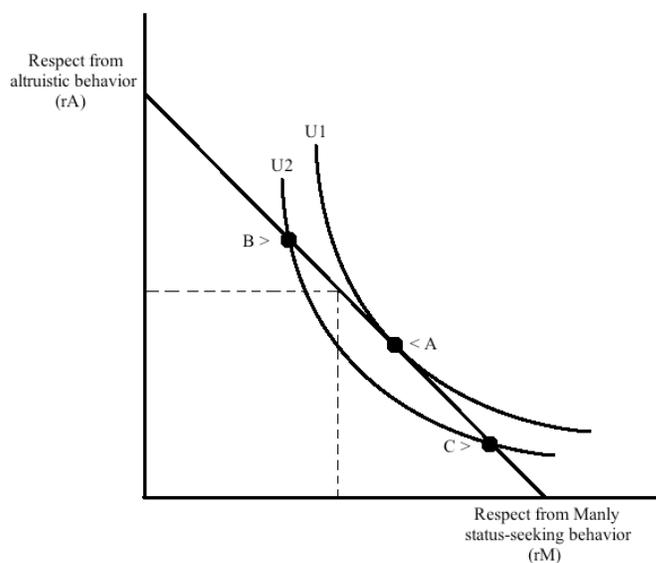


Figure 4.

standard theory has difficulty predicting decisions that are made when personal satisfaction conflicts with social standards. Below we adapt the standard model to address this scenario.

Since neither decision David can make will bring him satisfaction, his choice must be motivated by *minimizing utility loss*: choosing the option with the least regret. Here regret is referring to the regret felt for *not* picking an option. To adapt the model, we must include David’s *regret* parameters and add them to David’s utility function. David’s standard model utility function, as depicted in figure 4, has only two inputs: $U = f(r_A , r_M)$ where r_A = respect from altruistic acts, and r_M = respect from manly status-setting behaviour

($r_A \geq 0$; $r_M \geq 0$). David's adapted utility function must additionally contain two parameters for regrets: $U = f(r_A, r_M; R_A, R_M)$ where parameter R_A = regret caused by not choosing an altruistic behaviour, and parameter R_M = regret caused by not choosing a manly status-setting behaviour ($R_A > 0$; $R_M > 0$). We will build the regret parameters into the utility equation as exponent values for the choice variables r_A and r_M such that:

$$U = r_A^{1/R_M} \cdot r_M^{1/R_A}$$

As potential regret for not taking the altruistic behaviour increases (R_A increases), the exponent on r_M , respect from manly status-seeking behaviour, decreases, leading David to choose fewer manly status-seeking (r_M) behaviours relative to altruistic (r_A) behaviours. This equation allows us to predict that, all else equal, David will tend towards the behaviour with the largest exponent,⁸ following the assumption of utility maximization.

To explain the scenario where David appears to make a choice that lowers his utility (Figure 4 U2), we must understand how the coachman asking David to move changes the context of David's decision; the state of the world and David's response changes. At the beginning of the coach scenario, when David chose the r_M behaviour, we can assume $R_M > R_A$ because David believed he would gain more satisfaction for following the perceived social standard of manly status-seeking behaviour. Thus he chose a higher quantity of r_M than r_A . However, when the coachman asks David to vacate his seat, David's understanding of the situation changes because he realizes he can actually gain respect from the present individuals by acting altruistically⁹. This reduces the regret associated with not picking the manly status-seeking behaviour (R_M decreases), or increases regret for not choosing the altruistic behaviour (R_A increases) or both, allowing us to predict that David will tend towards the altruistic response due to the emotional factor regret. Depending upon how the parameters change, David can end up with less utility than if he had not been asked to give up his seat, even though in this new state of the world it is optimal for him to give up his seat. Thus, David is minimizing util-

ity loss from the interaction

In the standard model, David's decision to give up his seat had to be graphically drawn on a lower indifference curve (See point B on figure 4) in order to satisfy the axioms that lead to preference consistency. However, by interpreting David's decision scenario through regret we can see that the coachman's suggestion changed the information David had to base his preferences on. This allows us to draw his U^* indifference curve tangent to the budget line at point B and cross his $U1$ indifference curve without violating any axioms because the first state of the world is no longer valid. (See figure 5 U^*). In this model adapted for regret, we can predict David's choice while still allowing for a lower utility level after his decision because his regret parameters changed.

To conclude, the standard consumer theory model can be very accurate at describing preferences and predicting decisions. However, when personal satisfaction and social standards conflict, the standard model may fail to explain and predict behaviours. In the case of David Copperfield, adapting the model to incorporate the emotion of regret is one way to solve this problem. While this adapted model is specific to the agent and scenario presented, this type of exercise highlights the debate and issue of negotiating models' simplicity versus their validity. Models that do not reflect real human tendencies do not provide accurate predictions,

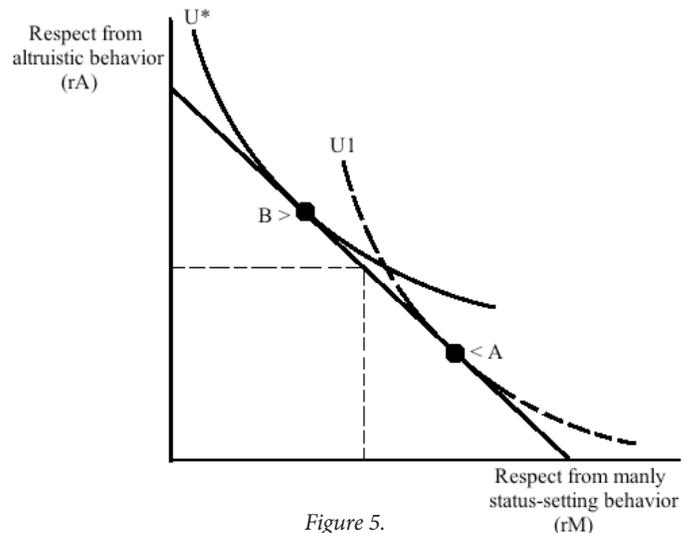


Figure 5.

8. Remember regret is the regret for not picking that option.

9. Despite the fact that this offer changes David's understanding of the situation, David's understanding of the broader social standard that motivated him in the first place remains unchanged. Thus, David still experiences a significant level of regret (see David's comment that this experience was the "first fall I had in my life," above), but it is less regret than he would experience if he did not change seats. Thus, *utility loss is minimized*.

but highly specific models designed to explain anomalous behaviours lack the generalizability that makes modeling a useful pursuit to begin with. However, evidence from behavioural economics suggests that emotional and irrational behaviours are not as anomalous or exceptional as standard economic theories assume. Continuing this discussion and finding ways to understand and build emotional factors into models should be further explored within the broader field of economics to increase its accuracy in explaining and predicting behaviours.

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