Think: Spend some time in your own head, with your eyes closed, and allow yourself to reflect on an encounter you had today.
# Knowledge Integration

## 2011-2012

**INTEG 420-421: Senior Research Projects**

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Message from the Director for the 4th year symposium proceedings

Welcome to the first Knowledge Integration Senior Research Symposium Proceedings. This is a collection of the papers presented by the graduating class of 2012, the very first recipients of the Bachelor of Knowledge Integration at the University of Waterloo, at their Senior Research Symposium, March 30, 2012.

Knowledge Integration is a unique experience in undergraduate education, built around breadth across the arts and sciences as well as depth in at least one area corresponding to each student's primary interest. What distinguishes Knowledge Integration is its core framework of courses for knowing and doing in a complex world that requires perspectives that transcend disciplinary boundaries. The core develops critical, creative, and integrative thinking throughout the four year curriculum, culminating in a senior research project anchored in the student's primary interest area and making the connections across disciplines that characterize knowledge integrators.

While our first graduating class is small in number, it is great in its diversity across the disciplines. You will find papers here that apply statistics to education in developing countries, that explore computer models of relationships in crowds, that present the research of Northern Studies scientists to the general public, that explore science, technology and society in the context of aboriginal epistemology, that examine the meaning and significance of polyphony in the work of Bakhtin, that help visualize webs of information between related content, that investigate ethical systems to encourage organ donation, and many more. Our students have found their supervisors across the Arts, Science, and Mathematics faculties of the University of Waterloo and beyond.

I am sure that a browse through these papers will support my own observation: Knowledge Integration students make connections others do not, and envision solutions others cannot. Both the diversity, and the depth, of scholarship presented here is remarkable.

Thanks to the students, and their multi-disciplined supervisors, for their trail blazing efforts in making this proceedings a reality. Special thanks to Kaleigh Eichel for putting all the pieces together and meeting the production deadlines.

Ed Jernigan,
Director, CKI
Indicator for the Millennium Development Goal, Universal Primary Education, Poorly Tracks Students’ Learning

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Abstract - This study examines whether or not net enrollment ratio, an indicator for the Millennium Development Goal, universal primary education, is a suitable proxy for students’ learning of hard and soft skills. The motivation behind universal primary education is to ensure that students are learning the basic skills necessary to overcome poverty. Simple linear regressions were conducted between net enrollment ratio and various global assessments. These included Grade 4 and Grade 8 Assessments from the 2007 Trends in Mathematics and Science Study (TIMSS) and the Grade 4 assessment from the 2006 Performance in International Reading Study (PIRLS). Results showed that there is a significant relationship between Grade 8 TIMSS mathematics and science assessments as well as PIRLS Grade 4 reading assessment. However, confidence intervals and the R² value revealed that this relationship is weak. When combined with anomalies in the distribution of results, we conclude that net enrollment ratio is a poor proxy and more culturally sensitive measures are needed.

I. Introduction

In 2000, the United Nations launched the Millennium Development Project designed to combat poverty, promote gender equality, and create sustainable partnerships around the globe. These initiatives were succinctly outlined in eight Millennium Development Goals for participating countries to complete by 2015[3]. In order to follow countries’ progress, the World Bank, the Organization for Economic Cooperation and Development, and the International Monetary Fund collaborated to create metrics (referred to as indicators by the Millennium Development Project) for tracking these goals[3]. The development of appropriate indicators is critical since these will signal where countries need to focus their attention and dedicate resources. Thus, improperly tracking these goals could have grave consequences in misrepresenting the actual needs of the local population and misallocating international resources.

This study explored if net enrollment ratio, an indicator for the Millennium Development Goal, universal primary education, properly tracks progress. The intent behind universal primary education is to empower children to overcome poverty through the acquisition of basic skills. Therefore, the specific focus of this study was to establish if net enrollment ratio is a good proxy of primary students’ learning, or more specifically acquisition of hard and soft skills. Hard skills are teachable aptitudes that can be defined and measured (i.e. students’ abilities in science). Soft skills are less tangible and harder to quantify (i.e. students’ study habits)[1].

II. Methods

This study was conducted in two phases. The first phase focused on determining the relationship between net enrollment ratio and student performance and the second investigated net enrollment ratio’s relationship with the acquisition of soft skills.

A. Phase One: Hard Skills

Simple linear regression models were used to determine the relationship between net enrollment ratio and countries’ performances on different international assessments. The assessments used were from two international studies, the 2007 Trends in Mathematics and Science Study (TIMSS) and 2006 Progress in International Reading Literacy Study (PIRLS). TIMSS assesses students’ abilities in grade four and eight in mathematics and science [7]. PIRLS gauges grade four students’ reading abilities [7]. Table 1 lists the assessment, the section scores available for each assessment, and the countries that participated. For TIMSS
assessments, there were additional scores for each grade and assessment: cognitive knowledge, application, and reasoning scores.

The following simple linear model was applied to countries' scores on each assessment and net enrollment ratio.

$$ Y_i = B_0 + B_1 x_i + E_i $$

where $i$=country, $x_i$ = country i's net enrollment ratio, $Y_i$ = country i's score on an assessment, and $E_i$ is the error not accounted for in the model with $N~(0, \sigma^2)$

Confidence intervals for $B_1$ and the $R^2$ value were obtained after model fitting. $B_1$ represents the amount of change in the score on a particular assessment with a one percent increase in net enrollment ratio. $R^2$ is the amount of variation in the score explained by net enrollment ratio. It is important to note that this analysis has made the assumption that the relationship between net enrollment ratio and student performance is linear.

**B. Phase Two: Soft Skills**

The second phase of the study explored the link between soft skills and net enrollment ratio. To do this, a principle component analysis was conducted between net enrollment ratio and countries' responses to questions on the 2009 Programme for International Student Assessment (PISA) Student Questionnaire. This questionnaire assesses 15 year old students' attitudes towards learning and education, and the principle component analysis was used to examine the entire data set and identify what variate explains the greatest amount of variation[1].

There are 30 countries that overlap between the PISA and Millennium Development Goals. They are: Albania, Argentina, Belgium, Brazil, Chile, Colombia, Croatia, Czech Republic, Estonia, Indonesia, Jordan, Kazakhstan, Korea, Kyrgyzstan, Mexico, Montenegro, Panama, Peru, Poland, Romania, Russia, Serbia, Slovakia, Slovenia, Thailand, Trinidad and Tobago, Tunisia, Turkey, and Uruguay [1].

The PISA Student Questionnaire is conducted on 15 year old students and its inclusion in this study could seem inappropriate, since the focus is on soft skills of primary school children. However, 15 year olds in 2009 were 6 in 2000, the starting year of the Millennium Development Goals. Thus, this age group can provide the greatest insight into the soft skills acquired in primary school [1].

### III. Results

#### A. Phase One

The results showed that net enrollment ratio is a poor proxy for student performance. Even in significant relationships, the 95% Confidence
Interval of $B_1$ and $R^2$ values were weak. The simple linear regressions showed that net enrollment ratio had a significant relationship with Grade 8 Mathematics, Grade 8 Science, as well as Grade 4 Reading total scores and section scores. The only exceptions for these assessments were Grade 8 Content Algebra Score and the Grade 8 Mathematics Cognitive Reasoning Score. Table 2 displays the confidence intervals $B_1$ and the $R^2$ value for the average total scores and net enrollment ratio.

According to this analysis, Grade 4 Science and Mathematics total average scores, as well as section scores, have insignificant relationships with net enrollment ratio since $B_1=0$ is contained in the confidence intervals. Even in cases where there are significant relationships like Grade 8 Mathematics, a 95% confidence interval shows that there is only a 1.5 to 9 point increase approximately with a one percent increase in score which is trivial on an assessment of 600 points. Further evidence shows that net enrollment ratio is explains only about 16 percent of the variation in score. Hence, there are other factors outside of net enrollment ratio influencing countries' performance.

### B. Phase Two

The principle component analysis revealed that, in the primary component, net enrollment ratio only explains about 7.5 percent of the variation in the data set. This suggests that net enrollment ratio is a poor indicator for students' acquisition of soft skills.

We must ask why net enrollment ratio is an insignificant determinant in learning. We posit three possibilities: the relationship between net enrollment ratio and skill acquisition is non-linear, ceiling effects, and a lack of cultural specificity in local education testing.

Evidence suggests the relationship between net enrollment ratio and student performance is nonlinear and that there is a ceiling effect. Assessments with significant correlations span a larger range of net enrollment ratios than assessments with insignificant correlations. Specifically, countries participating in Grade 4 Science and Mathematics have net enrollment ratios in the range of 89 to 100 percent while the others have the bulk of countries in the range 73 to 92 percent [1]. This suggests that the relationship between net enrollment ratio and student performance on assessments might actually be asymptotic. This means that for this lower range net enrollment ratio and performance can be modeled by a linear relationship. However, after a certain point, the relationship parallels the asymptote, and a linear relationship ceases to explain the data effectively.

The relationship may be asymptotic because there are decreasing returns with higher student enrollment. This analysis suggests that initially increasing student enrollment translates to better performance because there are simply more students in the classroom learning [1]. However after this initial basic educational need is met, other factors weigh more heavily on student performance than net enrollment ratio which echoes the results of the principle component analysis on soft skills.

Further investigation suggests that cultural ideologies and values will dictate student performance and acquisition of soft skills among the countries with the higher net enrollment ratios. The reason behind this is the required basic skills needed to overcome poverty vary depending on country. To explore this, a case study was conducted between Kuwait, Jordan, and Australia.

### C. Case Study

Each of these countries has roughly the same net enrollment ratio but vastly different average scores on the Grade 8 Mathematics (see Table 3). The case study sought to understand why.

<table>
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<tr>
<th>Country</th>
<th>Net Enrollment</th>
<th>Average Score</th>
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<tr>
<td>Kuwait</td>
<td>93.4</td>
<td>354</td>
</tr>
<tr>
<td>Jordan</td>
<td>93.8</td>
<td>427</td>
</tr>
<tr>
<td>Australia</td>
<td>94.7</td>
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Table 3. Comparison between countries
Kuwait is an extremely wealthy Gulf Monarchy that guarantees a certain quality of life to Kuwaitis because of cash transfers to citizens from the country’s oil revenues. Because of this security, the education system emphasizes academic and traditional subjects. In primary school, large amounts of time are dedicated to learning Arabic and Islam [2]. The current indicator does not capture this aspect of Kuwaiti children’s’ learning.

In Jordan, the needs of the education system are driven by their lack of natural resources. The monarchy is promoting an educational reform program that emphasizes vocational over academic learning since people are their most abundant factor of production [6]. Therefore, an understanding of vocational subjects; carpentry, mechanics, and so on; is a pathway to success. This vocational desire is tied into traditional subjects like Arabic and Islam.

Lastly, Australia has a core curriculum of mathematics, science, literature, and history in primary school. In addition to this, Australia requires students to participate in the Languages Other Than English (LOTE) Program where students learn a second language and take Investigative Culture Course[4].

This case study reveals that education is culturally referential, and more importantly, that the basic skills required in one country to overcome poverty are not necessarily the same as in another. Net enrollment ratio might be a suitable indicator for some countries but that does not necessarily mean that it is suitable for all. Therefore, further investigation should be focused on creating an indicator that accurately captures cultural educational intricacies.

IV. Discussion

This analysis recommends that the United Nations Development Program create a culturally sensitive indicator. However, there are potential risks. A culturally relevant indicator might condone unfair practices and propagate a view, particular to the United Nations Development Program, of the purpose of education which could be damaging or unconstructive for local cultures. Thus, there needs to be cautious development of the indicator and close monitoring of its implementation.

A culturally dependent indicator might condone unfair practices such as restricting education for females in Afghanistan under the Taliban in 1996. Should the indicator factor this in as a cultural specificity? It might be quite difficult and delicate to find the balance point between cultural intricacies and repressive educational practices. Therefore, the United Nations Development Program must proceed with attentiveness in delineating between the two.

These choices made by the United Nations Development Program will propagate a particular view on the purpose of education. It should be recognized that this view could be damaging and unconstructive for cultures [1]. However, the hope is that with broad and rotating representation on the United Nation's Development Program's Executive Board, biases will be mitigated and allow for a broad vision of the purpose of education [1].Constant re-evaluation is needed in order to alleviate problems and strengthen the indicator.

V. Reference

Organizational Motivations for Social Media Adoption and Use among Established Canadian News Providers

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Abstract - Over the past decade, television, magazine, and broadsheet news publishers have subscribed en masse to online social networks like Facebook and Twitter. Informed by historical, psychological, organizational, and communications research, this project develops a multidimensional understanding of what motivated this sudden and significant change in corporate strategy and consumer preferences. Semi-structured interviews with leaders and decision makers in established Canadian news organizations help to further evaluate this process. We argue that organizational engagement with social networks is motivated by a top-down push to pursue strategic marketing and management goals. Established Canadian news providers see social networks as a method of increasing readership and of improving online advertising revenue, but there are also more complex factors at play, including marketplace competition, team efforts to maintain employee engagement, and the promotion of altruistic corporate values.

I. Introduction

It has become common wisdom that traditional sources of news are in decline. Printed magazines and newspapers appear to be caught in a “death spiral” of declining readership and declining ad revenue.¹ The “24 hour cable news cycle” and participatory journalism have reduced the utility of employing professional journalists who deliver “hard-hitting” stories, to the point where the entire profession may be threatened.² Even television news, a mainstay of Western culture for decades, is vulnerable to high public perceptions of bias,³,⁴ and audience migration to online sources.²

The move to online news is characterized by more than merely a shift to online distribution. As online social network and social media technologies (in Canada today, Facebook and Twitter are among the most popular) become more and more prevalent, new content producers, as well as elements of the traditional international news media, have attempted to leverage their increasing popularity for organizational, industrial, and personal benefits.

Using theories of communications, management, and psychological gratification, this project is a description, analysis, and integration of the varied motivations for the adoption of social technologies by established Canadian news organizations.

Consumers are driven to online social networks⁵ in order to assuage personal and social gratifications. Organizations do not have the same needs. I argue that organizational engagement with social networks is motivated by a top-down push to pursue strategic marketing and management goals. Established Canadian news providers see social networks as a method of increasing readership and of improving online advertising revenue, but there are also more complex factors at play.⁶

II. Methods

Given the rapid pace of innovation in the technology sector, engagement with online social networks is a constantly evolving effort. A relatively steady pace of publications continues to study various organizations’ successes and challenges in the adoption of these technologies. Few, however, have considered the underlying psychological mechanisms behind such strategies.

In order to evaluate the motivations for online

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¹ Following the rationale laid out by boyd [sic] & Ellison,² in this paper I use the term “network” for social media generally, and “networking” for profile-based interactive social networks.
activities, it is necessary to speak to leaders and handlers in the industry.\textsuperscript{b} Using online search, published rankings of media property significance, and self-reported audience sizes, we identified Canada’s leading 47 English-language news publishers. In order to ensure representation from all corners of the Canadian population, to consider the activities of smaller but still established news providers, and to increase the overall number of participants, an additional 6 organizations (all print publications targeting rural, Northern, and cultural communities) were included in this list.

Using organization charts on public websites, specific employees from each media property were targeted for their involvement in social media, communications, web activities, and/or promotions. Where no contact information could be found, the invitation to participate was sent to a general contact address. The recruiting letter encouraged candidates who did not feel eligible for the study to forward the invitation to a suitable colleague. Ultimately, invitations to participate were sent to 53 candidate organizations.

Targeted organizations spanned eight provinces and one territory. Mediums included television (n=10, 19%), radio (n=15, 28%), and print (n=28, 53%). Using the founding date (for television), date of most recent format change (for radio), or date of most recent name change (for print), the mean age of organizations was 62 years, with a median of 37 years and a range of 232 years.

Seven contacts agreed to be interviewed, for a participation rate of 13%. Those who acknowledged receipt of the invitation but refused to participate cited reasons including a shortage of time (n=5), and a lack of relevant expertise (n=1). One message was returned “undeliverable.”

Interviews were semi-structured in order to guide the process but still allow participants to express their motivations independent of the interviewer’s theoretical underpinnings. Questions included “How strongly do you feel your employer supports your social media activities?” and “Tell me when and how your organization first got involved with X social network.”

III. Results

The small sample size, low participation rate, and emphasis on qualitative data inhibit statistical analysis of responses. Nonetheless, a number of trends are evident.

Interviewees indicated that their organizations participated actively in a number of different social networks with a moderate variety of functionalities. As one would expect, organizations with larger budgets and higher message output engaged in a greater diversity of networks, and also were more likely to have more than one official account on the same network.

In general, the person or team that manages social network accounts for an organization manages all social network accounts for the organization. Except in large and de-centralized organizations, teams did not divide responsibilities along service lines, but rather shared them amongst each other, splitting tasks based on time of day, individual workload, and areas of personal journalistic expertise and interest.

Respondents indicated that they use social media in order to drive audiences to other messages and other channels, to improve the ability of the message to reach the destination, to “connect” with audiences, and to provide “interactivity.” There was a general consensus that decision makers in the organizations in question considered successful engagement with social media to be a high priority, but that total efforts so far still represented a very minor portion of organizational investment and output.

Every participant considered their social network efforts to be successful, at least within their primary demographic (regional, cultural, or national). They noted that the level of interactivity and of noise depends on the transmitter, with social networking sites the most interactive, blogs and micro-blogs next, and content communities least interactive. No organizations had any substantial engagement with virtual worlds or collaborative projects.

The importance of innovation, thought leadership, and interactivity was stressed throughout the interviews. When asked about risk management, participants often noted that their organizations are already careful to appear professional and to prevent errors, but that formal policies were generally avoided by deferring to staff competence.

Major media personalities were often singled out by participants for being more successful than their employers at utilizing social media, but respondents

\textsuperscript{b} This project received ethics clearance through the Office for Research Ethics at the University of Waterloo.
were reluctant to push too hard to leverage these followings, for fear of ostracizing talent, overstepping personal-professional boundaries, or appearing to manipulate or influence reporters. Respondents ultimately felt that social media offered an opportunity to distinguish their organizations within their competitive mediums, but did not feel that it had a substantial role to play in stepping between mediums (i.e. Radio stations continue to excel at audio production, and lag in written work and video production, and are comfortable with this separation).

IV. Discussion
Preliminary data analysis revolves around three themes: (1) Strategic motivations, (2) mood management, and (3) perceptions of credibility.

1. Strategic Motivations
By their very nature, newsmedia organizations are compelled to pursue a set of specific objectives. Using Hallahan’s conceptualization of strategic communications, we can see that the Canadian news organizations studied by this project must carefully balance 4 different priorities: Marketing, management (e.g. by dividing labour tasks between members of a team in order to maintain their interest), public relations, and information. Surprisingly, technical communications did not factor in for these organizations, as respondents found that newsrooms are usually so small that technology is not needed to facilitate internal dialogue. The limited deployment of social networks so far has also not promoted political communications (e.g. interviews, lobbying) for established Canadian news groups.

2. Mood Management
Gratification theory posits that human behaviour is powerfully influenced by a compulsion to immediately satisfy certain needs—personal, social, altruistic. The results of this study appear to partially refute this theory, at least in the context of organizations and social networks. Short of their salaries, Canadian social media managers do not appear to receive any significant recognition or interpersonal rewards for their roles. Even at the organizational level, non-participation is not heavily criticized within the industry.

Participation in social networks does not appear to significantly affect the personal mood, interpersonal relationships, or organizational functioning of established Canadian news outlets.

3. Perceived Credibility
Competition between news organizations is fierce. Participation in social networks appears to increase in-group perceptions of news innovation and promptness. In addition, corporate values—generally internal, but also sometimes socially-oriented—featured prominently for many respondents. It therefore appears as though participants (both on an individual and at an organizational level) believe that participation in online social networks benefits the wider community, and perhaps causes a greater social good.

Organizational engagement in online social networks is motivated by strategic marketing and management needs. But there are also more complex issues at play. Established Canadian media groups and their employees have intertwined their corporate responsibilities with their social responsibilities. Social networks allow them the rare opportunity to pursue both of these objectives simultaneously.

This integration of organizational priorities is often effective, but rarely explicitly stated. Other news groups would be wise to formalize and promote such an efficient use of resources.

Future research should endeavor to quantify these trends by utilizing psychological assessment tools with company employees, complete and fungible data sets, and very narrow, specific case-studies.

Parts of this paper are adapted from an earlier version, which was submitted for course credit in INTEG 420 at the University of Waterloo in December 2011.

V. References
Assessing tree species biodiversity and soil quality of an alvar red pine (*Pinus resinosa* Ait.) plantation at Misery Bay Provincial Park, ON

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**Abstract** - Biodiversity is a measurement of the species richness and evenness of an ecosystem. This study focuses on analyzing biodiversity at a red pine (*Pinus resinosa* Ait.) plantation in Misery Bay Provincial Park located on Manitoulin Island, Ontario. As a restoration strategy, red pines were planted at the site following a forest fire in the 1960s. Methods for analyzing tree species biodiversity, the soil macronutrients phosphorus, nitrogen and potassium, and soil pH were used to determine the quality of habitat of the plantation compared to adjacent and reference mixed woodland alvar sites. Tree and sapling species sampling was done using a point centre quartered method. Two biodiversity indices, Shannon and Simpson, were applied to the collected data and show that the biodiversity values for the red pine plantation are lower than the other two sites. The results of the soil analysis indicate that nitrate-nitrogen and phosphorus are lower within the red pine plantation compared to a reference site but potassium is present in higher quantities. The pH of the soil varied between soil horizons and was slightly more acidic within the plantation. Further analysis of the soil nutrient content and pH is needed to determine statistical significance.

**I. Introduction**

Misery Bay is an operating provincial park within the Ontario Parks system that protects and manages alvar habitat. Alvar is a type of ecosystem that is characterized by limestone or dolostone bedrock covered sparsely with soil⁴. Common tree species found at Misery Bay include red pine (*pinus resinosa* Ait.), white pine (*Pinus strobus* L.), eastern white cedar (*Thuja occidentalis* L.), white spruce (*Picea glauca* Moench), red oak (*Quercus rubra* L.), and red maple (*Acer rubrum* L.).

In 1964, before the park was provincially owned, a forest fire burned a large section of the alvar at Misery Bay. The land owners intended to increase the rate of restoration of the burned area by planting red pines (*Pinus resinosa* Sol.) which were affordable and available at the time. Red pines are native to North America and were planted in large numbers for restoration purposes across Ontario in the early to mid 20th century². Red pine plantations have since been a source of ongoing forest ecology research but few studies exist that examine red pine plantations on alvar ecosystems.

The research aim of my thesis was to explore the effects of planting red pines on the burned area of Misery Bay including the impacts on tree species biodiversity, soil nutrient content, and soil pH. I hypothesized that the planting of red pines following a forest fire on an alvar ecosystem has decreased tree biodiversity 47 years later and degraded the soil quality.

**II. Methods**

I identified three sites within the study area. Site A was within the red pine plantation, Site B was adjacent to the red pine plantation, and Site C was the reference site. Site C was the reference site because it is presumed to not be located within the 1964 burn and is located in a mixed woodland alvar ecosystem that is similar to the other two sites.

Within each site, trees were sampled using the point centre quartered method which has been used in similar studies³. Sampling points were located every 10 m along 5, 25 m transects. Each sampling point was divided into 4 quarters in which the nearest tree species, diameter at breast height (DBH), distance to the tree, and the nearest sapling were recorded. A DBH of 4 cm was the
distinguishing line between tree and sapling and has been used in other studies that examine forest species composition. The data was then analysed using biotic indices and importance values were calculated for each species. The biotic indices used were the Simpson Index, which represents the likelihood that two randomly selected trees will belong to different species, and the Shannon Index, which has a maximum value when all species are present in equal numbers.

Three soil samples were taken at each of the three sites using a hand auger. The locations of the soil samples were randomly determined using a grid and Microsoft Excel’s random number generator. Soil horizons were analysed at the University of Waterloo’s Ecology Lab in January and February 2012. The soil nutrients nitrate-nitrogen (N), phosphate (P), and potassium (K) were measured using the Cadmium Reduction Method (N), the Ascorbic Acid Reduction Method (P), and the Tetraphenylboron Method (K). Measurements were taken with a Lamotte Smart 2 Colorimeter and converted to kilograms per hectare (kg/ha). Soil pH was measured using a handheld, portable multimeter and a ratio of 1:2 for soil and distilled water.

III. Results

The importance values in Table 1 show that Site A has the lowest tree species richness (7 species) and appears to be dominated by white and red pines. Red pine has an importance value of 50%. White pine appears to be the most important species (28%) at Site B, followed closely by balsam fir (26%). At Site C, the control site, balsam fir (Abies balsamea L., 34%) and red pine (24%) are the most important species. Only 18 tree saplings were sampled at Site A. This is in comparison to the 56 and 60 tree saplings that were sampled at sites B and C.

The results of the Shannon and Simpson biodiversity indices support the conclusion that Site A is the least biodiverse (Fig. 1). Sites B and C have higher values than Site A for both indices. Using the Simpson index Site A achieves a score of 0.55, Site B is at 0.74, and Site C is at 0.75. Using the Shannon index, Site A achieves a score of 1.11, Site B is at 1.62 and Site C is at 1.60.

The results of the soil analysis are summarized in Table 2. The total depth of soil for Site A was 0.44 m, for Site B it was 0.70 m and for Site C it was 0.69 m. Nitrate-nitrogen content was the highest for all horizons at Site C with the exception of the second horizon where sites B and C both have a value of 6.73 kg/ha. Phosphate was present in the highest quantities at Site C for all soil horizons. Potassium was the most variable nutrient measured, with values ranging between approximately 26 and 194 kg/ha between horizons and sites. For the first soil horizon, potassium was present in the highest quantity at Site B (194.48 kg/ha). For the second and third soil horizons, potassium was present in the highest quantity at Site A (59.97 kg/ha, 76.78 kg/ha).

The results of the pH analysis show that overall values ranged from 4.22 to 6.14 for Site A, 4.04 to 6.25 for Site B, and 3.87 to 5.10 for Site C. The soil pH varied between horizons and the third soil horizon had the highest pH for all cases. All soil pH

<table>
<thead>
<tr>
<th>Species</th>
<th>Importance Values (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
</tr>
<tr>
<td>white spruce</td>
<td>14.10</td>
</tr>
<tr>
<td>black spruce</td>
<td>-</td>
</tr>
<tr>
<td>white pine</td>
<td>24.73</td>
</tr>
<tr>
<td>red pine</td>
<td>50.54</td>
</tr>
<tr>
<td>jack pine</td>
<td>-</td>
</tr>
<tr>
<td>balsam fir</td>
<td>2.68</td>
</tr>
<tr>
<td>red oak</td>
<td>2.72</td>
</tr>
<tr>
<td>red maple</td>
<td>-</td>
</tr>
<tr>
<td>white birch</td>
<td>2.66</td>
</tr>
<tr>
<td>white cedar</td>
<td>-</td>
</tr>
<tr>
<td>unknown 1</td>
<td>2.57</td>
</tr>
<tr>
<td>Total</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Table 1: Summary of tree species importance values for sites A, B, and C at Misery Bay. Tree species were sampled in the fall of 2011 (N = 60, 56).

Figure 1: Graph summarizing the results of the Shannon (triangles) and Simpson (squares) biodiversity indices for tree species at Misery Bay sites A, B, and C. Tree species data was collected in the fall of 2011.
### Table 2: Summary of mean depth of soil horizon, mean soil nutrients nitrate-nitrogen (N), phosphate (P), and potassium (K), and median soil pH for sites A, B, and C. Samples were analyzed January to February 2012 and N=3 for each soil horizon at each sampling site.

<table>
<thead>
<tr>
<th>Horizon</th>
<th>Site</th>
<th>Depth (m)</th>
<th>N (kg/ha)</th>
<th>P (kg/ha)</th>
<th>K (kg/ha)</th>
<th>pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A</td>
<td>0.14</td>
<td>8.97</td>
<td>3.95</td>
<td>154.12</td>
<td>4.58</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>0.14</td>
<td>6.73</td>
<td>6.82</td>
<td>194.48</td>
<td>4.89</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>0.11</td>
<td>10.09</td>
<td>12.20</td>
<td>128.90</td>
<td>5.69</td>
</tr>
<tr>
<td>2</td>
<td>A</td>
<td>0.34</td>
<td>5.60</td>
<td>6.82</td>
<td>59.97</td>
<td>4.10</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>0.36</td>
<td>6.73</td>
<td>7.89</td>
<td>34.75</td>
<td>4.23</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>0.36</td>
<td>6.73</td>
<td>8.97</td>
<td>42.59</td>
<td>5.51</td>
</tr>
<tr>
<td>3</td>
<td>A</td>
<td>0.44</td>
<td>4.48</td>
<td>3.23</td>
<td>76.78</td>
<td>4.76</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>0.70</td>
<td>6.73</td>
<td>12.55</td>
<td>25.78</td>
<td>4.75</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>0.69</td>
<td>8.97</td>
<td>34.43</td>
<td>27.46</td>
<td>5.07</td>
</tr>
</tbody>
</table>

Data points were below 7, indicating that the soil is acidic at all three sites.

### IV. Discussion

An analysis of the importance values shows that the forest at Site A, within the red pine plantation, is comprised of only two species. At sites B and C, the importance values are lower and distributed between more species. In addition, at many of the sampling points, there was only one sapling present. This means that as the red pines age there are few saplings to replace them. The majority of these saplings are balsam fir.

The similar values for the biodiversity indices at sites B and C may indicate that Site B, which is adjacent to the red pine plantation, is not negatively impacted by its presence. If Site B was located within the area of the 1964 burn, then it appears to have returned to a natural system because it is similar in species evenness and richness to the reference site, Site C.

Soil nutrient content and pH are important for determining the species composition of plant communities and nutrient deficiencies can affect plant growth. Statistical methods were not used to compare soil nutrient concentrations or pH between sites because small sample sizes, such as is used in this study (N=3 per soil horizon and site), have a low probability of detecting significant differences between means. However, the results of this study suggest that the macronutrients nitrate-nitrogen and phosphorus are present in lower quantities within the red pine plantation. One study found that trees grown in a mixture, rather than a monoculture are more efficient at up-taking nitrogen and phosphorus. Potassium has been more widely studied in agricultural systems than in forests but one study found that there was a high retention of potassium in a red pine plantation. This could explain the high concentrations of potassium observed at Site A.

Red pines plantations have been shown to have high rates of mortality in alkaline soil due to iron deficiencies. However, the pH of the Misery Bay plantation is acidic. This may indicate that it will not undergo the mortality seen in other red pine plantations.

Overall, I would suggest that further soil analysis of the three sites outlined in this study be conducted. The quality of soil in the red pine plantation at Misery Bay could be determined with more certainty by using 20 or more samples per soil horizon and site which was the quantity used in similar studies that found statistically significant differences in mean soil nutrients. If restoration action were to be taken, I would recommend techniques such as selectively removing older red pines to open up the forest canopy which have been proven effective at allowing the reestablishment of native species in other studies.

### V. References

Assessing organizational identity, identification, and its potential impacts: A pilot study of two undergraduate programs at a Canadian university

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Abstract – Understanding organizational identity, a concept defined by Whetten in 1985 as “the central and enduring attributes of an organization that distinguish it from other organizations”, is valuable to an organization because it reveals how its members internalize its observable characteristics. The embodiment (or lack thereof) of these forms the basis of organizational identification. This pilot study expands the scholarship on organizational identity and identification through a survey of 81 students (49 complete responses) from two University of Waterloo programs: Knowledge Integration and International Development. The survey seeks to quantify the participants’ identification with their respective programs, their shared faculty (the Faculty of Environment), and the university (UW), as well as the respective claimed and understood organizational identities of each separate group. Although the results indicate that a quantitative approach is a meaningful method of measuring organizational identification and identity, the organizational identity of the programs could not be meaningfully assessed because of a low survey completion rate and a vast variation in responses. The design of this pilot study allows it to become a scalable study to measure the organizational identity of larger organizations and the smaller subunits of which they are comprised.

I. Introduction

Identity is a contextual description that provides answers to existential questions such as “Who am I” and/or “Who are we?”¹, and exist for both individuals and organizations when conceived comparatively and relationally.²⁻³ Organizations differentiate themselves from on another through distinguishing identity referents (or attributes) shared amongst their members.⁴ These attributes are the preserved and perceived past actions that an organization views as key to their current success. Overall, they represent the identity of a collective actor.⁵

The most significant distinguishing identity referents of an organization are the most enduring (time-tested organizational elements) and central (essential to explaining the organization)⁶. Thus, organizational identity derives from a contemporary view of the past, present, and evolving central and enduring distinguishing referents of an organization⁷⁻⁸. Moreover, because organizational identity can be observed from past actions, it can also be empirically measured. The more the members of an organization share, understand, and internalize attributes, the stronger the organizational identity⁹.

Organizational identification occurs when members view the organization’s central, enduring, and distinguishing characteristics as self-defining¹⁰. Because the embodiment of identity characteristics is the key to identification¹¹, organizational identity and identification are related and can be correlated. The stronger the organizational identity, the stronger the possibility is for organizational identification.¹²

Scholarship on the two subjects has demonstrated
that a strong organizational identity and a shared positive organizational identification amongst members increase an organization’s potential for success. For example, at universities, students that have more positive organizational identifications with their schools are more inclined to donate as alumni, be more involved on campus, and overall have a positive, successful student experience. Conversely, students with more negative organizational identifications are more inclined to have an unhealthy amount of stress in their lives, become prone to binge drinking, and have lower academic performances.

II. Methods

For this thesis, a quantitative pilot survey was developed and conducted with two University of Waterloo programs: Knowledge Integration (86 registered students) and International Development (146 registered students). Students in both programs were emailed through their student society mailing lists and told that if they filled out the survey, they could win 1 of 7 $10 gift cards. The surveys were identical except for questions that referenced a respondent’s respective program. The goal of the pilot study was to quantify the participants’ identification with their respective programs, their shared faculty, and the university, as well as the respective claimed and understood organizational identities of each separate group.

To quantify organizational identification, students answered nine questions about their program, faculty, and university on a Likert scale from 1-5. The questions and scale were synthesized from Mael and Ashforth’s 1992 organizational identification model and Jackson’s 2011 group identification dimensions. However, to garner meaningful quantitative measurements of the central, enduring, and distinguishing attributes of organizational identity, the survey included an original series of ten questions (four relating to distinguishing attributes and six concerning enduring attributes) that allowed students to express their individually understood identity referents about their program, faculty, and the university. The six ‘enduring’ questions asked students to define what characteristics they believed had always, and would continue to, characterize their program, faculty, and the university. The four ‘distinguishing’ questions asked respondents to reveal and rank what characteristics they believed differentiated their program, faculty, and university, from specifically defined comparable organizations. For example, when each respondent was asked to differentiate their program, their responses were devised in relation to the University of Waterloo’s undergraduate Urban Planning program in the same faculty. Respondents were also asked to elaborate on the attributes that they chose to provide further context and rank their distinguishing attribute choices for their program, faculty, and university to provide a way to calculate central identity attributes. In order to contextualize the survey data, respondents answered personal questions such as their academic year and whether or not they had attended high school in the region.

III. Results Highlights

Although 81 people participated in the survey, only 49 completed it. 18 were from International Development (INDEV) for a 12.3% response rate, and 31 from Knowledge Integration (KI) for a 36% response rate. In the organizational identity survey, INDEV students distinguished themselves from Planning students primarily by claiming that they were more focused on global social and political issues. However, they scarcely mentioned this focus when questioned about the enduring aspects of their program. As well, approximately 50% of participants from both programs ranked the Faculty of Mathematics as the faculty most dissimilar to their own. Additionally, whereas students from both programs differentiated UW from the University of Toronto by its geographic location and lack of community, Wilfred Laurier University was differentiated because of its contrasting academic focus and its social aspects. When
differentiating between universities, KI students did not mention the term interdisciplinary as an attribute of distinguishing characterization of UW. Finally, the term innovation was used an overwhelming number of times by participants from both programs. In the organizational identification survey, KI students, in comparison to their INDEV counterparts, consistently had weaker identifications on all of the identification dimensions related to the Faculty of Environment, specifically on questions relating to categorizing themselves as apart of the group. As well, both INDEV and KI students consistently responded that they did not identify with other UW students outside of their program and faculty.

IV. Conclusions
The results of this pilot study further demonstrated the dynamic nature of organizational identity and the incredible amount of variation that exists between sub-groups (such as programs) within an organization. Unfortunately, the combination of a low survey completion rate and a vast variation of responses about distinguishing and enduring organizational identity referents did not permit a more meaningful representation of organizational identity to be developed. While the organizational identification model was an excellent way of determining the various dimensions of group identification, the newly developed organizational identity methodology did not accomplish its task. The methodology would have benefitted from fewer questions, more concise instructions, and a different method of correlating the distinguishing and enduring characteristic responses. Despite this setback, the design of this pilot study still allows it to become a scalable study to measure the organizational identity of larger organizations and the smaller subunits of which they are comprised. As well, it can also provide organizations with a method of creating longitudinal research on the nature of evolving and solidifying central and enduring organizational identity referents.

V. References
5. Ibid.
22. analysis.uwaterloo.ca
Illustration of muscle activity during human gait using electromyography data

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¹ Centre for Knowledge Integration, University of Waterloo, Waterloo, Ontario Canada

Abstract - The beauty and form of the human body has often been the subject of artwork, and the movement and mechanics of the human body have been similar explored by scientists over the years. However, a combination of these two elements holds value as both an advancement of anatomical artwork and as a reference for scientific study. This project uses electromyography data collected during human gait to create eight life-size figure drawings. These eight drawings represent the stages of the gait cycle to show the levels of muscle activity during movement. The end result is a series of drawings that create a visual illustration of the flow of human gait that is simultaneously a work of anatomical artwork that emphasizes the grace of the human body during movement and a technical diagram to be used for scientific reference. This work may be displayed in a gallery or similar setting as part of an art exhibition to expose laypersons to anatomical artwork, but also may be used in an educational manner to aid in the teaching of anatomy and biomechanics. A promising future addition to this work will be a similar project examining symptomatic gait.

I. Introduction

Electromyography data is used in kinesiology to study the electrical signals sent off by muscles when they are in use. The data used in this project is surface electromyographic data (EMG), recorded using electrodes attached above the muscles or muscles groups to be examined. EMG data is used to study fluctuations in muscle activity, especially to compare symptomatic and asymptomatic individuals to examine how impairments of movement affect muscle use. Here, EMG data will be used to examine the activity of leg muscles during gait in an asymptomatic individual. Prior artwork that shares similarities to this project have focused on photography of human movement¹² or are focused as anatomical or medical illustrations.³ This project will focus on taking a less scientific and more artistic perspective on the subject matter; this perspective produces artwork that is more approachable for a lay audience, while still preserving its value in a scientific capacity.

II. Data

In this project, the muscles from which EMG data were recorded were vastus lateralis, vastus medialis, the lateral and medial hamstrings, rectus femoris, and the lateral and medial gastrocnemius, using electrode placement in standardized locations. A reference electrode was used to minimize discrepancies in the data. The data was collected from the right leg, however in asymptomatic individuals, muscle activity is identical in both legs and is the same across all individuals. After collection of the EMG data, it was processed to correct of subject bias and converted into microvolts, and normalized into a percentage of MVIC.⁴ Maximum voluntary isometric contractions (MVIC), is a measure of the maximal contraction (100%) should activate as much as the muscle as possible.⁵ Final number values of the data range from approximately 0 into the mid 70s, and are representative of the MVIC. The value for each interval was calculated by finding the average; because of this, the values will not be precise. However, the general level of activation will still be represented in the drawing of each interval. A more precise representation of the EMG % MVIC can be seen in Figure 1. The maximum and minimum of the data range of values was determined, and nine percentage ranges were chosen to best represent the range of values, with each range representing 5% and ranging from 0 to 45, the minimum and maximum after averaging. These ranges were used to determine the colour
coding of the drawings.

III. Drawings

The artwork consists of eight life-size figure drawings, approximately 157.5 cm tall, representing the stages of the gait cycle. The artwork is drawn on Mylar, a translucent polyester film, and was drawn with an India ink brush pen layered on top of pencil outlines. Colour was added using gouache paint to represent the level of muscle activity; a rainbow scheme was chosen as the colour range (violet, blue, teal, blue-green, green, yellow-green, yellow, orange, red) to best represent the change from “cool” or less activated to “warm” or more activated. The stages of the gait cycle are separated into stance and swing phase, and are shown in the drawings in the following order: loading response, mid stance, terminal stance, pre swing, initial swing, mid swing, terminal swing, and push off. The gait cycle, in this case, begins with the right foot. In order to create the large scale of the drawings, smaller scale outlines of the stages were created on Mylar and muscles were drawn in using anatomical reference. Pictures were taken of the smaller drawings. Mylar was cut into 42 by 72 inch pieces and mounted on a wall. Using a projector, the pictures of the small drawings were projected onto the large sheets of Mylar, and an outline was traced in pencil. Once the outlines were complete, they were refined with an India ink brush pen and muscles were painted with the appropriate colour of gouache to represent their activation level.

IV. Future Work

Future plans for this project are to continue the artwork begun in this project by creating another series of drawings focused on illustrating muscle activity in individuals who are symptomatic i.e. experience some form of movement impairment. For the relevance of this project, I hope for it to be utilized by both professionals and laypersons. It has potential to be used to educate, whether in a classroom for kinesiologists or physiotherapists, or for a layperson to better understand their own body. There is also potential to be part of artistic exhibition to further the exposure and development of anatomical artwork.

V. References and Acknowledgements

Thanks to Cheryl Kozey and Sandra Curwin at Dalhousie University for their generous provision of the EMG data to this project and for their guidance.
1. Eadweard Muybridge, Walking
2. Etienne-Jules Marey
3. Emily Evans, Hurdles, United Kingdom (2012)
First illustration of the series of eight figure drawings. Represents the loading response (or heel contact) phase. Figure is approximately 157.5 cm tall. India ink and gouache on Mylar.
The development of a science audio program in podcast form, *Avioyak*, intended for a general audience

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² Churchill Northern Studies Centre, Churchill, Manitoba, Canada

**Abstract** - The Churchill Northern Studies Centre (CNSC) mandate “to understand and sustain the North” through research and educational programs provides a broad framework for collaboration between subarctic research and education. To meet this mandate, an online audio podcast, *Avioyak*, was created to engage a dispersed and varied audience by translating specialized scientific knowledge through firsthand accounts by the researcher, which was simplified and made more accessible by adding narration. Fourteen scientists actively carrying out research at the CNSC during the summer of 2011 were interviewed to create five, 20 minute long episodes focusing on ecological concepts. The creation of the podcast occurred in 5 steps: design of each episode, prototyping the first two designs with feedback from audience surveys, production of the final episodes, creation of the accompanying website, and promotion of the podcast. This audio podcast overcame the barriers of science illiteracy, language and public indifference to integrate science knowledge into an accessible public forum (www.avioyak.ca).

I. Introduction

The goal of *Avioyak* is to share the scientific research occurring in the Churchill region with the Churchill Northern Studies Centre (CNSC) community by making the research available to a target audience that has varying educational backgrounds. An audio podcast meets the requirements for broad geographic accessibility over the Internet and can be designed to meet the educational level of the target audience, including visitors and the general public who are involved with the CNSC. Promoting science builds a stronger CNSC community by maintaining communication and showcasing work at the CNSC.

The first objective is to design an episode structure and style to present northern research that is accessible to both non-scientists and specialized researchers, then test the episode design through prototyping and surveys to analyze knowledge retention and episode structure. The second objective is to develop five episodes of a podcast presenting research in the Churchill area. The third objective is the creation of a website to make the podcast available with additional content such as photographs in order to engage visual as well as auditory learners. A fourth objective is to inform the target audience of the podcast through active promotion of *Avioyak*. Meeting these objectives for the podcast will make the scientific research occurring in the Churchill region accessible to the CNSC community.

II. Episode Design

The design of the episodes was informed by case studies evaluating the style of current scientific public radio programs: *Quirks and Quarks*, *Radiolab*, and *All in the Mind* (1, 2, 3). The case studies analyzed style for organization, diction, and tone. *Quirks and Quarks* organizes episodes through a live interview “question and answer” organization with a focus on significance of the scientific findings while *Radiolab* and *All in the Mind* both edited the interviews to focus on placing the findings into context with broader scientific topics that are intrinsically interesting, e.g. evolutionary reason for helping, and placing the interviews into a story about the research. The diction in all the case studies showed the use of colloquial, common language to explain ideas, thereby avoiding complicated jargon. The tone of *Radiolab* and *All in the Mind* was less formal and used humour and emotion to engage the audience, while the tone of *Quirks and Quarks* was more professional and serious. The style gradient between these programs provided a general review of current public radio science programs that informed the design choices for *Avioyak*, which used elements from each of the case studies to create an entertaining, engaging and educational podcast for a general adult audience.

III. Prototyping and Survey

The episode design was prototyped during a
survey study to test knowledge retention and episode style (ORE #: 17583). In the fall of 2011, 3 groups of visitors to the CNSC participated in the survey by listening to a prototyped episode and then answering a questionnaire. The test cast group listened to the prototype of episode 1 “Nothing to eat.” The improved cast group listened to a revised prototype of episode 1, “Nothing to eat.” The final cast group listened to a prototype of episode 2, “Little Droplets of Sunshine.”

The survey consisted of two portions: knowledge retention and design feedback. An interference question at the beginning of the survey acted to simulate the decay of knowledge of the concepts in the episode so that the test of knowledge was not based upon immediate recall of the material (4). The results of the knowledge retention portion illustrated that the chosen style does lead to the retention of the main concepts of the episode and that the audience can also think critically about the concepts in a new context, meeting the objectives of the first three levels of Bloom’s taxonomy: knowledge, comprehension, and application (5).

The design feedback section used Lickert scale (6) and open commentary, summarized in Table 1, to provide feedback on the design of the episode to improve engagement in the target audience. The feedback from the surveys informed the production of the final 5 episodes.

IV. Episode Production

The production of the final episodes involved selecting the interviewees, conducting the interviews, scripting, receiving interviewee feedback and revision. Interviewees were selected based on the ability of the researchers to communicate their captivating work and the potential interest of the targeted audience. The majority of the interviews were conducted during the summer of 2011 at the CNSC in a classroom or in the field with additional interviews during winter 2011-12 by telephone to fill in missing information.

Next, the narration was scripted with the edited interview to create a simplified, engaging story of the research. Then, the episode was sent to the interviewees for feedback on topics to ensure scientific accuracy and revised if necessary. Each episode had its own unique challenge to overcome:

1. “Nothing to Eat”: The main challenge was that this was the first episode and the design and style was not yet established.
2. “Little Droplets of Sunshine”: The main challenge was how to alter the episode style to finish an episode when the research was still in progress and the results were inconclusive.
3. “The Battle of Zooplankton”: The main challenge was how to connect three separate research projects in one episode.
4. “The Mystery of the Migrant”: The main challenge was how to finish an episode when the research was still in progress and the results were inconclusive.
5. “Getting your feet wet”: The main challenge was how to conclude the podcast series.

V. Website Design and Implementation

After the episodes were created, it was essential to create a delivery mechanism, www.avioyak.ca, to make the episodes accessible to the broad geographic target audience. The design of the website emphasizes the individual episodes by directly linking to each episode on every page of

<table>
<thead>
<tr>
<th>Topic</th>
<th>Comments from all cast groups (n=58)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understanding of the episode</td>
<td>• &quot;I thought it clearly explained the purpose of the experiment and presented new concepts clearly. It was not too academic to follow for the ordinary person.&quot;</td>
</tr>
</tbody>
</table>
| Style and Design | • "They made it sound like fieldwork is fun and energy from passionate people is infectious. It made me smile listening to them."
• "Animated narration and humour was good, but it was too youthful and personal. The public would not get all humour."
• "The visuals were relevant and contributed to explaining the methods used." |
| Audio quality and production | • "The sound was a bit distracting with hi/low volume changes."
• "The pop-ins of voices became a bit distracting."
• "The pace of information was very fast making it a bit difficult for me to digest it that quickly."
• "Better enunciation would help."
| To whom the participants recommended the episode | • 31 similar comments (general audience): "Yes, to anyone with an interest in biology, climate change, or environmental sciences."
• 10 similar comments: "I would recommend it to younger students as they may enjoy the tone."
• 4 similar comments: "I would recommend it to NPR or CBC; "Yes, to radio, schools, or zoos."
• 3 comments (target audience): "Yes, to local residents or visitors to Churchill." |
the website (Figure 1). Each episode has its own internal page where visitors can stream or download the episode, see pictures of the research, follow related links and read a concise description of the episode that includes leading questions to instill curiosity to learn more by listening to the full episode. The use of pictures in the design engages visual learners in addition to auditory learners. The website also builds community around the podcast and the CNSC through the use of social media (e.g. Facebook, Twitter) and through the use of direct comments on the website where discussion of the episodes can continue. The website is the distribution and the community building mechanism for the podcast.

VI. Promotion

A promotional marketing campaign was designed to ensure the success of the podcast by making the target audience aware of Avioyak. A unique logo was designed to emphasize the English translation of “avioyak,” “buzzing in ears,” by including the translation in the logo and by association of “buzzing” with the image of a mosquito that follows the Inuit print tradition (Figure 1).

Promotion of Avioyak to the CNSC community is both direct and indirect. The target audience will be contacted directly through emails and the CNSC newsletter. The CNSC community will also receive indirect communication through advertising posters placed strategically in the Town of Churchill, radio segments on the local radio, a link to www.avioyak.ca from the CNSC website and the CNSC research blog, and the Knowledge Integration website. Community will continue to be built through Facebook, Twitter, and comments directly on www.avioyak.ca to provide opportunity for future initiatives (i.e. contests, media creation projects). Academic interests in the podcast will also be spread through the use of academic posters and presentations at conferences.

VII. Conclusion

The research occurring at the CNSC is truly important for the broader public to be aware of due to its implications for conservation and the potentially severe impact of climate change in the North. Through public communication of the research occurring in the Churchill area, Avioyak has the potential to build a stronger community around the CNSC, which can lead to future support of research and conservation efforts. More personally, Avioyak provided an opportunity to leave a legacy in the digital world beyond what a traditional thesis could offer due to the potential longevity that internet content is capable of providing and the direct utilization by the CNSC to continue sharing northern research.

VIII. Reference

5. IUPUI Center for Teaching and Learning, Office for Professional Development, Indiana University-Purdue University, Indianapolis, (2002).

IX. Acknowledgements

I want to thank my supervisor for all the 8 am meetings, advice on all topics, and for helping me to always do my best. Also, thanks to all the researchers who so openly shared their work and ideas for this project, and to everyone at the CNSC and KI for supporting me as the project developed. Also, thanks to the Faculty of Environment for funding.
Clinical Ethics Committees as a Model for Socially Relevant Philosophy of Science

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Abstract — Recent work in a new project calling for a more socially relevant philosophy of science has suggested philosophers of science should engage directly with scientists, and with stakeholders who have a vested interest in scientific research. The goals of this engagement are to improve scientific research, applications thereof, philosophical theories, and interactions between expert and lay communities. In hospitals and other medical institutions, clinical ethics committees advise on philosophically troubling problems that arise in medical practice. These committees are typically interdisciplinary, often including philosophers alongside hospital workers. In this project, I use clinical ethics committees as a model for doing socially relevant philosophy of science. Section I describes socially relevant philosophy of science and the benefits of such work. Section II introduces clinical ethics committees, their functions, membership, and motivations. Section III uses clinical ethics committees to develop a model for similar committees in scientific practice, which I call philosophy of science committees. Section IV discusses some challenges faced by clinical ethics committees in anticipation of similar issues for philosophy of science committees.

I. Socially Relevant Philosophy of Science¹

Socially relevant philosophy of science (SRPOS) is a new project that calls for philosophers of science to become more engaged with scientists and the stakeholders that stand to be affected by scientific research, especially lay communities. There are three main aspects of SRPOS.

The first is "philosophical analyses of scientific research topics and scientific practices that are directly relevant to public welfare." Examples of these research topics include toxicology, race genomics, and psychological sex differences. Relevant scientific practices include how scientists engage with lay communities, interact with private investors, and choose research programmes.

The second is to focus on or engage with various stakeholder groups. Stakeholders are those who have an interest in scientific research not only because they "can benefit from or be harmed by scientific practice," but also because their participation in the scientific process can improve the production and sharing of knowledge.

The third is to change or critique the "practices and venues in which philosophers of science engage to maximize the social impact of their work." This includes collaboration with scientists, policy makers, and educators, as well as dissemination of philosophical work to broader audiences by, e.g., publishing opinion pieces, popular books, or in scientific journals.

SRPOS can provide a number of benefits. Because of the nature of the scientific topics under consideration, it is important that these projects be designed and executed appropriately. Philosophers might clarify important concepts, identify methodological or ideological assumptions, call attention to and suggest corrections for epistemic failures, or determine why important scientific knowledge is not receiving uptake in lay communities. These efforts can improve the way science is applied in society, how publics take up scientific knowledge, and the quality of scientific research itself.

Furthermore, this work can enrich the field of philosophy of science in general: "SRPOS can develop new areas of philosophical research, raise questions that are interesting and philosophically relevant, and offer new insights on traditional topics." SRPOS can also demonstrate the usefulness of philosophical analysis to a broader audience, which may open up new opportunities for philosophers to contribute to the public good and move the discipline away from its tendencies to social and academic detachment.
Several authors have presented specific ways for philosophers of science to go about doing SRPOS. These include devoting some professional research to projects that can protect the public good by analysing and critiquing scientific research, becoming more involved in science education, and mediating between expert and lay communities in interactions between science and society.

However, given the emergent nature of this project, a more specific model may be instructive to those wishing to begin such work. In the next section, I describe a potential model used widely in medical clinics to address relevantly similar issues.

II. Clinical Ethics Committees

Clinical ethics committees (CECs) help hospital physicians, nurses, staff, and patients resolve medical ethical dilemmas. Their typical purposes are education for medical personnel, patients, and the broader community to clarify concepts and explicate ethical issues that arise in medical practice; counselling hospital workers when ethical issues arise; dispute resolution when physicians and patients or their families disagree on treatment; and reviewing institutional policies to ensure they encourage ethical practice in the hospital. The CEC’s decisions in disputes are typically non-binding; the emphasis is on discussion and reaching consensus rather than imposing a solution.

In Canada, CEC membership typically includes physicians, nurses, clergy, hospital administrators, bioethicists, social workers, and community representatives. CECs are required for hospital accreditation in an increasing number of countries across the world. Canadian CECs have experienced strong success in their educational goals, and moderate success in their other ambitions.

There are clear parallels between clinical ethics and SRPOS. Both began out of concerns about philosophically troubling issues that arise in interactions between expert and lay communities. Both seek to engage philosophers with the broader community, lay and academic, and to assist in resolving these issues, often as mediators. And both challenge experts to consider the effects their practice has on other stakeholders.

These similarities suggest that CECs could serve as a model for facilitating SRPOS at research institutions, such as universities. Indeed, previous work has suggested that engaging scientists and interdisciplinary collaborators in philosophical discussion has positive results. The next section sketches this model and gives an example.

III. Philosophy of Science Committees

Philosophy of Science Committees (POSCs) would facilitate SRPOS by bringing together scientists, philosophers, and stakeholders to discuss the issues mentioned in Section I. Their membership would include philosophers of science, practising scientists, community representatives, university administrators, other philosophers (especially ethicists), and possibly legal experts.

Among their functions would be to educate scientists and lay communities (as well as relevant decision-makers, such as university administrators and policy makers) about philosophical issues in science, such as conflicts of interest when accepting private funding or the role of values in science. POSCs could also provide advice to researchers who wish to discuss current or past cases where they have a concern with respect to these issues. Additionally, POSCs could advise the institution on policy development to ensure research is done in a responsible way. Finally, POSCs could serve as mediators between lay communities and researchers when conflicts arise, and on an ongoing basis to pre-empt any such conflicts. Unlike research ethics boards, the decisions of POSCs would not often be binding: their purpose is primarily consultative.

Consider the following example. Following the Chernobyl disaster, rainfall deposited radioactive materials in some parts of Great Britain. This led to far greater than maximum tolerable levels of radioactivity in lamb meat from the Cumbrian fells. A ban was imposed on Cumbrian lamb, and when radioactivity levels did not decrease as quickly as expected scientists were sent to investigate.

These scientists "relied on their own theoretical models for doing field research, and did not solicit the advice of the sheep farmers." This led to several scientific mistakes. Assumptions about radioactive material depositing and dispersion were based on models developed for terrains with groundwater flow and soil types that were different from local conditions. Experiments attempting to clear out radioactive materials, where sheep were fed grass mixed with an absorbing mineral, failed because scientists ignored the farmers' knowledge of how sheep graze. These errors, among others, diminished the value and accuracy of the research, prevented the public benefits the scientific
investigation was supposed to provide, and led to the farmers distrusting the scientists.

These problems could have been avoided if the scientists had attended to the farmers’ concerns and valued their local knowledge. The farmers were aware of the soil type and drainage patterns in their fells, as well as the grazing behaviours of their flocks. The scientists’ narrow view of scientific expertise, however, caused them to overlook and actively ignore the farmers’ input.⁶

A POSC may have been able to improve the situation by mediating between the farmers and the scientists. During the research programme, the farmers or any concerned researchers would have raised the issues described above to the committee. The POSC would then gather the parties together in discussion to reveal misgivings and assumptions, and work toward having the farmers’ perspectives included in the research (where appropriate). It has been suggested that philosophers of science acting as mediators might be able to accomplish these goals alone,⁶ but the support and interdisciplinary perspective of a POSC would contribute to a richer discussion. In addition, educational programmes run by POSCs may have been able to pre-empt this situation: the scientists would have been taught to recognize when lay communities have relevant knowledge to contribute.

IV. Challenges for CECs and POSCs

The literature on CECs describes several challenges they face in practice. First, empirical research has shown CECs in Canada have difficulty monitoring themselves to ensure effectiveness in completing their goals.⁸ Second, CECs need to strike a balance between their association with hospital administration (which grants them some authority and respect) and their independence therefrom (which ensure clinicians will feel comfortable coming forward with concerns). Third, CECs must gain acceptance amongst clinicians and must be seen as providing a valuable service, if their services are to be used. Fourth, CECs need to consider how proactive they are within the hospital; too much and they risk being seen as the "ethics police" and a bureaucratic burden, too little and they risk overlooking ethical issues in the hospital that are going unnoticed by clinicians.

POSCs would encounter similar challenges. Like CECs, POSCs would have to ensure they monitor their effectiveness closely. They would also need to keep some distance from institutional administration, bureaucracy, and existing research ethics boards to avoid being seen as another administrative overseer, while still maintaining enough of a connection with administrators to facilitate uptake of their recommendations. In addition, scientists must be shown that POSCs can benefit their research and its application in ways scientists could not achieve themselves in order to be accepted as valuable. POSCs should also take care not to be too proactive, lest they be perceived as unwelcome auditors, but they should occasionally step in when problems are going unnoticed.

V. References & Notes

1. Much of the following appeared previously in Goetze, T. National Integrative Research Conference (2012).
The Slow Food Movement: A Comparison between Canadian and Italian Cultures

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Abstract - The Slow Food Movement was created in 1986 in response to fast food and society’s “fast living.” The movement created by Carlo Petrini rejected the idea of fast food restaurants in favour of using local ingredients to create dishes that respect the environment and promote healthier lifestyles. Slow Food currently exists in 132 countries and has grown to over 100 000 members since its start in Italy. However, the Slow Food Movement has made a “slow move” to Canada. There are cultural differences that have allowed for slow food to permeate into Italy but not quite into Canada. However, it is not only cultural differences but also geographical, political and historical changes that affect the way a culture eats. The three tenets of Slow Food include the values of being “good, clean and fair” which describe the movement and its purpose to society. These ideals bring forth issues such as affordability, accessibility, globalization, convenience and sustainability as reasons for choosing or perhaps not choosing this lifestyle of eating. Despite slow food being a larger movement in Italy, there are also some influences from the West (North America) that have shifted the “slow life” into a fast paced lifestyle for the younger generation of Italians. In addition to cross-cultural movements, multiculturalism also plays a role in the decisions of everyday people whether they are in Canada or Italy.

I. Introduction
The Slow Food Movement started as an opposition to fast-food restaurants in Italy but has grown to become more than just about food. The Slow Food Movement is about a lifestyle. It is about a way of living with which the Italians embrace as a culture every day. Although some Western influences have seeped through cultural barriers, it can be seen that Italy overall wants to preserve and maintain the traditions of the past and pass them on to future generations. However, the Slow Food Movement has grown out of Italy into other areas of the world including Canada. Slow Food operates in convivias or local chapters in Italian. In addition to this, there are approximately 2000 “food communities” that work together to create small scale farming that incorporates the values of Slow Food by ensuring that it is sustainable, ethical, clean and good. Slow Food consists of produce and products that are grown or raised with pesticides, fertilizers, hormones or antibiotics. Food grown around the world is typically done so in order to keep up with the demand in developed countries. In order to produce more, additional fertilizers and pesticides are needed to ensure there is an abundance of crop. Therefore, if food is grown organically and naturally, (or perhaps a better word would be “slowly,”) then farmers will have to charge more in order to maintain a living. Organically grown food has a sticker price that not everyone is willing to pay. It is more expensive because it costs more to produce. As prices for food currently increase, the problem remains whether slow food can become a lifestyle for Canadians. The price for local organic food exceeds that of food imports with unknown growing practices. Also, fast food has become the cheaper and faster alternative to which Canadians live a fast-paced life. However, despite slow food being a larger movement in Italy there are influences from the west that have shifted the slow life into the fast paced life for some Italians.

II. Methods
In the initial investigation, a comparison of the two cultures was conducted over a timeline to determine details in history that may affect the way a culture eats. In addition to this, interviews were
conducted at the local Slow Food Market to discover the eating habits of Canadians along with their demographics to further understand how their decisions are made. For the purpose of this thesis, their names have been changed to retain anonymity. There are also books written by the founder of the Slow Food Movement (Carlo Petrini) that recount his motives and desires for eating and living well. Furthermore, journal articles and websites pertaining to the Slow Food Movement were used to conduct research for this thesis.

III. Results

The cultures of Canada and Italy have different reasons for deciding to eat slow food. Canadians choose to eat slow food because it is a statement of being environmentally friendly and being fair to farmers. The choice to eat locally grown produce reflects a decision to support an economy here at home. Italians on the other hand choose slow food because it is a way of life. The Slow Food Movement is not a movement for them; it is a lifestyle that has been entrenched historically and culturally. However, there are other reasons to why the Slow Food Movement has been slow to move to Canada. First, it is important to note the multiculturalism of Canada which brings forth globalization (distribution of goods and services on a worldwide scale). Globalization is a direct contradiction to what the Slow Food Movement supports which makes it difficult for a Canadian to choose what to eat. Furthermore, affordability comes into question as organic and sustainability grown food costs significantly more than food grown on an industrial scale. It was also found that geography (land use, agriculture, and climate) along with accessibility contributes to the decisions that Canadians make about the food they buy and eat. However, it is with convenience that defines the decision to choose the slow food lifestyle or not. With the invention of the microwave, ready-prepared meals, and of course fast-food restaurants, it is possible to understand the current lifestyle of a typical Canadian who is surrounded by time-savers.

IV. Discussion

When Carlo Petrini started the Slow Food Movement in Italy, he did so with the intention to ensure that Italian values of eating good, clean and fairly were incorporated into his vision. These three ideals became the tenets for Slow Food International and other various chapters around the world. Why is eating good, clean and fairly important? Eating good uses the season’s best produce that is grown locally and sustainably. Clean foods require eating produce that is free of hormones and antibiotics. To be fair means to support the local economy and to give small food producers a chance to provide for the community as well as their families. The culture in Italy is a cross between new and old generations. The old generation in which Petrini is a part of appreciates the old ways of food. Food grown in the garden is used to prepare fresh food daily. It takes more time but there is a difference in the quality and taste of
processed versus freshly prepared food. There is also the new generation of Italians. They are being influenced by the ways of the West and in particular the values of North America. To that, the Slow Food Movement was created to counter the effects of the Western lifestyle. Italians approach slow food as something they are accustomed to. They understand what it means to create meals from scratch but will not only take the time to make it but to enjoy it as well. Food is more than sustenance; it is a product of a farmer’s work to bring good, clean food to the table. It is the effort to ensure that food is more than just a commodity but also a symbol of good faith between the earth and the consumer. While there is a fight to maintain traditions, there is also a fight to allow new ideas to come to Italy. The reason why Italians can embrace slow food is because it is important to them. It is not because they have any additional hours on their clock but food is an immense part of their culture. Therefore, they make the time for it. It is possible for Canadians to make time for things but simply prioritize food below others. It is already known that Italians typically eat meals differently from Canadians. For breakfast, Italians will eat small and light. A coffee with a biscuit or a small Italian breakfast food is typically consumed. There is a morning rush, therefore breakfast is consumed quickly. In Canada, breakfast is a different for every person depending on how much time is available. Breakfast foods range from cereals, oatmeal, eggs and various meats such as sausage, bacon and ham. Breakfast in Canada also follows the Food Guide and tries to incorporate all food groups into the meal such as orange juice for fruits or milk for dairy. There is also deep emphasis on the importance of breakfast in Canada and is considered the most important meal of the day. However, the most important meal of the day for Italians is lunch. This is the largest meal of the day and is eaten slowly as a sign of respect for the preparer of the meal. This is also because Italians tend to take long breaks after lunch to rejuvenate after eating a large meal. As a result, dinner is eaten at a later time so that projects for the day can be completed. This lifestyle is not seen in Canada as long lunch breaks do not include naps and rest before returning to work or school. If this happened, Canadians would also expect a longer work day and dinner at a later period. Dinner for Canadians is also a large meal that is consumed in the evening but not as late as the Italians. In Italy, dinner is consumed after 7 and 8 P.M. and restaurants do not reopen until this time. The difference in eating may also explain why Slow Food can remain a part of Italian life but not in Canada. There is no right or wrong in this situation, lifestyles are based on a person’s preference and should not be forced upon them. However, there is such thing as a “better” lifestyle and to most Italians; slow food would be the best choice.

V. References
10. Scialabba, Matthew. The Italian Farmer’s Table: Authentic Recipes and Local Lore from Northern Italy. Guilford, Conn: Three Rivers Press, 2010.
The effect of edge characteristics on social epidemic progression

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Abstract - The spread of social epidemics, from Pokémon cards to Google plus, is a fascinating and important phenomenon of modern online culture. Marketers want to know how to get word of their products out. Savvy consumers want to know which products will catch on and which won't. This project assesses our ability to model the spread of such social epidemics on a network by representing individuals as nodes and their relationships as edges (a.k.a. ties or links) between nodes. Prior work has investigated how to model the effect of the node characteristics on the spread of the social epidemic. Instead, we propose a statistical framework that models the effect of edge characteristics – that is, the characteristics of the relationships between individuals – on the progression of social epidemics. Our model allows us to test theories of social epidemic progression. In addition to this conceptual framework, we provide software that can generate or process social network data, assign properties to those nodes, simulate the spread of the social epidemic, and output statistics and visuals to aid analysis.

I. Introduction

What makes an idea go viral? This is the basic question that drives our research. It can be helpful to view the spread of ideas as a “social epidemic”. Since people become “infected” with an idea and go on to spread it, a social epidemic has many of the same properties as a medical epidemic (1).

The analysis of a social epidemic relies on an understanding of the social network underlying its spread. In a social network, people are connected to each other via their relationships. We represent people as “nodes”, usually represented visually as a circle. If two people have a relationship, there exists an “edge” between them. This is represented as a line connecting two nodes. A collection of nodes and edges is called a “graph” or “network”.

Epidemic analysis has to rely on an underlying epidemic progression model. Common models used include the SI, SIS, and SIR models. These abbreviations denote the possible states a person can be in at a given point during the epidemic: either “susceptible” (S), “infected” (I), or “removed” (R). In the SI model, people can be "susceptible" (uninfected) or "infected". Nodes move from susceptible to infected, and all epidemics eventually plateau at 100% infection (assuming every node is connected to every other node). In the SIS model, people can become uninfected, as if they had fought off the disease (or abandoned the new idea, in a social epidemic) at which point they become susceptible again. In the SIR model, people move from susceptible to infected to removed, where “removed” represents either death or immunity (2). Our proposed framework assumes an SI model of social network progression, but could be expanded in future to make different assumptions.

A medical epidemic can be at least partially measured; physicians can test patients for pathogens and assess who infected individuals have had contact with. The advent of online social media means we can now measure social epidemics in a similar way. Of course, challenges remain; it is hard to be sure if people are infected, it is hard to find out when they became infected, and it can be hard to determine exactly to whom they are connected. Nonetheless, the ability to gather data on the actual progression of a social epidemic has become possible, and it is natural to try to use such data to learn how the properties of the network influence epidemic progression.
II. Contribution

We propose a statistical model of social epidemic progression that is based on “edge characteristics” and is motivated by social science theory. Using computer-simulated epidemics, we show how the parameters of this model can be estimated from data. We also show how graph topology influences the quality of our estimates.

Previous work, for example by Christakis and Fowler (3) and VanderWeele (4), analyzes the spread of epidemics (obesity and smoking) across a network as a function of “covariates” derived from node characteristics. The covariates that influence infection are derived from the node properties of the “ego” (node) and the “alter” (the node’s friend) who are connected by that edge. An example of a node property would be its age (e.g. 26), a covariate would be an age category (e.g. 25-29), and an outcome would be their decision to smoke.

We propose instead to model the progression of the epidemic as a function of covariates derived from edge characteristics, that is, the properties of relationships between nodes. In this case, the covariates of a node are an aggregation of the properties of all of its edges to adjacent nodes in the network. We take this approach because not all edges are equivalent; for example, the relationship between a manager and her employee is different from her relationship with her childhood friend.

Our model can take these differences into account when determining whether the manager will soon be infected by the idea, and bases the probability of that infection on this description of a social situation. We assume that each covariate influences the probability that a node will become infected on the next time step according to a logistic model. In this model, each covariate is associated with a weight that describes how the covariate is correlated with infection. We wish to be able to estimate these weights from data.

III. Methods

To assess whether learning the weights is feasible, we have developed computer software that takes a graph, a list of edge characteristics, and proposed weights, and simulates an epidemic. It outputs an ”outcomes matrix” of covariates, each of which is an aggregation of the characteristics of the edges incident with each node at each time step of the epidemic. It also stores whether or not the node is infected at each time step. The resulting data simulates what might be collected from a social networking site. From this data (which is a perfect description of the epidemic, in the reality we have constructed), we can run a logistic regression to estimate the weights associated with the different covariates. By comparing the estimates to the true values (which we know), we can test the feasibility of this kind of analysis, and probe the potential problems.

To make the analysis as realistic as possible, we used graph topologies from real-world data. We generated edge characteristics randomly and chose weights to be as realistic as possible. We constructed seven different case studies to test our ability to estimate how edge characteristics relate to infection probability on the next time step. Cases 1, 4, and 6 examine 870 Livejournal users, and Cases 2, 3, 5 and 7 examine 34546 academics.

IV. Results

Figure 1 shows the true weight values passed in for each case study, along with the values estimated from the simulated data and confidence interval widths.

In Cases 1 and 2, the properties were chosen based on Robert Cialdini’s work on influence (5), but our approach would allow for other choices of properties. Covariates were defined as a sum of incident edge characteristics; if nodes had more neighbours they were more likely to be infected. Two lessons can be drawn from Cases 1 and 2: First, as expected, more data leads to much greater confidence. Case 2’s estimated weights have higher confidence than those of Case 1. Second, computation time is influenced by infection rate and network size. Case 2 took far longer to execute. The 1558 time steps of case 2 only infected half of the nodes before reaching our computational limits. As a rule, the tail end of the epidemics in these case studies took longer. Running 4000 to 5000 time steps could take 24 hours, which has implications for using this type of analysis in near-realtime.

Case 3 modified case 2 by normalizing the covariates. A normalized covariate is given by the sum-based covariate divided by the total number of neighbours the node has. This resulted in a change in the “scale” of the characteristics that caused the entire population of the larger graph to become infected in just 20 time steps. The result was much lower confidence in our estimates. This highlights another issue with this kind of analysis: an
epidemic that progresses too quickly may not yield enough data for researchers to analyze.

Cases 4 and 5 used normalization but adjusted the baseline parameter, which controls the chance of spontaneous infection, i.e. infection that occurs when a node has no infected neighbours. The baseline value was adjusted to limit chances of a spontaneous infection to 0.5%, thus slowing the epidemic. The resulting data gave confidence in the estimated parameters comparable to Cases 1 and 2.

Cases 6 and 7 demonstrate the flexibility of the framework we have developed to study different kinds of properties. The new covariates measure degree of similarity and ask if at least one neighbour is infected. These come from Bibb Latané’s Social Impact Theory (5).

Through our simulations, we have shown that the feasibility of analyzing social epidemic data is influenced not only by the nature of the network topology and the size of the network, but by how the epidemic progresses. Further investigation of this relationship is needed to make the best use of this new source of social science data.

V. References


<table>
<thead>
<tr>
<th>Covariates</th>
<th>Case 1: 870 nodes</th>
<th>Case 2: 34546 nodes</th>
<th>Case 3: 34546 nodes</th>
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<tr>
<td></td>
<td>Truth</td>
<td>Est.</td>
<td>CI (95%)</td>
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<td># Infected</td>
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<td>Frequency of Contact</td>
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Figure 1. A summary of the results. Intervals not containing the true value are italicized. A smaller confidence interval (C.I.) represents more confidence. The beta values (Truth and Est.) were chosen to be as realistic as possible; they represent the relative importance of the different aggregate characteristics. The numbers describe how the aggregate characteristics are correlated with probability of infection; a -1.0 represents a negative correlation.
Collaborative Communication: Epistemic Perspectives on Aboriginal-Western Scientific Collaboration in Canada

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Abstract – While it has been readily acknowledged that complex global problems typically require interdisciplinary solutions, infrequently is adequate attention given to the diversity of paradigms and types of knowledge that may also come into contact while conducting research and generating policy solutions. In the Canadian context, researching and addressing scientific challenges often requires collaboration between Western academic communities and the long-term Indigenous inhabitants of the land. Research in feminist and social epistemology could contribute a great deal to this discussion, both in terms of affirming the importance and legitimacy of Indigenous voices as absolutely essential to the dialogue, and in addressing failures in current approaches to collaboration. In this paper, I offer a brief overview of such potential epistemic contributions, attempts at communication through co-management regimes, and opportunities for the future.

I. Introduction

Complex environment and governance issues like climate change, resource management, and sustainable development are truly interdisciplinary challenges whose potential solutions demand an integrated and trans-disciplinary approach to problem solving. Yet, rarely is adequate attention given to the deeper kinds of integration often required to address these sorts of problems. In the Canadian context, a particularly important diversity of perspectives comes from a rich history of Indigenous inhabitation, experience, and knowledge across the country.

In this paper, I intend to illustrate the ways in which literature from social and feminist epistemology is uniquely positioned to contribute to this important field. In particular, I will examine three key considerations. First, I will suggest that epistemology can offer a strong articulation of some of the many reasons why its essential to include Aboriginal voices in these conversations. Turning to the work of Paul Nadasdy, I will then outline challenges facing traditional approaches to incorporating Indigenous voices through co-management regimes. Finally, I will combine these epistemic insights with the field of Socially Relevant Philosophy of Science to suggest potential opportunities for better equipping scientists, journalists, and academics in general to be able to be better prepared and equipped for such discussions. In making these recommendations, I will offer a brief glimpse of the ways in which this study has yielded a humbling appreciation of the importance of examining ones’ own assumptions, proceeding with an earnest eye towards learning and relationship building, and becoming an ally of Indigenous voices themselves.

II. Epistemology of Pluralism

As a discipline, philosophy has long been dominated by established, western, and male voices, at the exclusion of the perspectives of other genders, worldviews, and experiences. Epistemology is no exception, where treating ‘knowers’ and ‘knowledge’ as discrete and interchangeable resulted in reinforcing stereotypically white male ways of knowing as the only valid approach to conceptualizing and understanding the world (1). Feminist perspectives have worked to challenge and undermine these assumptions in several ways, including through the theories of situated knowledge and epistemic plurality.

The work of Donna Haraway (2, 3), for instance, has been groundbreaking in advancing the theory of situated knowledge. Arguing that knowledge is
fundamentally conceptualized through the experiences, worldviews, and locations of each unique knower, she illustrates the way that acknowledging this reality leads to more accurate and transparent understandings of what it means to hold objective knowledge. Similarly, other feminist epistemologists have articulated the way that being forthcoming about the nature of this intrinsically situated and social knowledge can increase the quality of scientific discovery (4, 5).

Not only do these theories illustrate the nature of situated knowledge, but they have implications for diversity as well. Because each individual knower has different experiences and resources to draw on, they offer a unique epistemic toolkit for contributing to scientific, academic, and other discussions. Moreover, having collaborators from different social locations makes it more likely that faulty assumptions, rash judgments, or accidental misinformation can be identified by others. Having broader participation can also ensure that the generated knowledge is more likely to be accepted widely, lending credibility and objectivity to the position (6, 7). While such diversity means that each member must be more committed to being open minded (8), not to mention that the groups must be carefully structured and facilitated to find points of shared interest (9), diversity indeed has great promise for improving knowledge generation in collaborative ways.

Beyond simply appeals to diversity, however, these acknowledgements of knowledge as situated, dynamic, and fundamentally social in character are drastically important for finally welcoming Indigenous ways of knowing into traditionally Western institutions. As Aboriginal author Kathleen Absolon describes,

“searching for knowledge promotes an identification of location, which I think is distinctively Indigenous and goes directly against the positivist Euro-western research presumption that there is only one truth, that neutrality and objectivity are possible, and that to safeguard against research bias, the researcher’s location doesn’t (and cannot) matter” (10)

I am distinctly aware that language that suggesting that Westerners or Western institutions need to “validate” Indigenous ways of knowing for them to be seen as acceptable risks the same sort of colonial and paternalistic attitudes that have oppressed for so long. Yet, by finally affirming and welcoming long-held traditions of knowing in different ways, perhaps scholars like myself can finally and humbly make room in academic discourse for key missing voices to speak for themselves.

III. Co-Management: A Viable Solution?

As demonstrated in some of the basic tenets of feminist and social epistemology, bringing together many diverse viewpoints can not only make participants feel more connected to the process (compared to more authoritative, non-involving regimes), but can also lead to better use of epistemic resources and, thus, better knowledge generation practices. At their most basic level, institutionalized co-management boards offer the promise of achieving these benefits.

Governance mechanisms for bringing together diverse groups of stakeholders in a more equitable and consensus-based process, co-management boards are typically implemented by some level of government to allow more direct community involvement in decision-making. The Nunavut Wildlife Management Board, for instance, is a collection of both Inuit community members and territorially/federally appointed participants, tasked with resource management and environmental protection across the territory. Co-management boards can be defined through emphasizing the creation of shared responsibility (11), shared authority (12), or the institutional mechanisms making such collaboration possible (13).

Yet, while co-management boards can indeed bring together a diverse group of people, not all see them as strictly a blessing for Aboriginal communities. In the analysis of Paul Nadasdy, an anthropologist who spent three years living with the Kluane First Nation in the southwestern Yukon, co-management boards can unfortunately do far more to force Aboriginal communities to adopt western ways of knowing than to empower Indigenous worldviews (14). Such institutionalized mechanisms, in the analysis of Nadasdy, serve to implicitly demand that Indigenous communities adopt Western ways of structuring bureaucracies (ignoring localized community dynamics and social ways of knowing), speak in Western languages (primarily English, but particularly legal jargon), and pay nothing more than lip-service to authentic ways of knowing (out of a self-censoring fear that their decisions will be rejected unless justified in
Western, scientific ways). Indeed, in the case of the Nunavut Wildlife Management Board, for instance, the bureaucratic structure and regimented western reporting (seen in minutes and published documents) raises concerns that this analysis may be accurate (15).

IV. Moving Forward

Clearly, while co-management boards may exist for the right epistemological motivations, there are many reasons to believe that not only are their diverse epistemic resources effectively limited, but they may actually have negative effects on the communities in which they are instituted. Furthermore, as I discuss in my full thesis, there are reasons to believe that attempts at co-management may be birthed from and institutionalize (albeit unintended) colonial and patriarchal attitudes towards Indigenous peoples in Canada. If even this collaborative strategy is problematic, is it possible to move forward? I would argue yes, although it will require time, patience and understanding.

While the theoretical analysis undertaken in creating this paper is characteristic of epistemic work, the part of this research that was both the most challenging and rewarding was personally struggling through this process of encountering new worldviews and ways of understanding. Tangible skills were required, which I was able to practice to varying degrees of success. Active listening, empathizing, and avoiding making judgments were each important when encountering radically different ways of seeing the world. A willingness to reconsider personal assumptions about basic notions of ‘truth’, ‘knowing’, and ‘research’ was essential. Perhaps most difficultly, patience and resilience was required when feeling discouraged or attacked during the process.

If scientific collaborations are to be successful between these groups in the future, however, such interactive abilities need to be cultured and developed from early on in ones’ scientific training. In its present form, science education (at least in Ontario, Canada) puts a heavy emphasis on fact teaching and lab skills development, at the expense of competencies for science students in the humanities, social science techniques, and even interactive abilities. The burgeoning field of Socially Responsible Philosophy of Science (16) is active in developing a deeper understanding of many of these interactive abilities. Work by Kyle Whyte and Robert Crease, for instance, explores the process of trust-building in community-scientist relations (17), and could be leveraged effectively in the development of more holistic, inter-personal skills enhancing programs for science education.

Finally, let me acknowledge the irony of my writing this paper as a Westerner. For far too long, Western voices have presumed to speak on behalf of Indigenous peoples, whether directly questioning their abilities or unintentionally perpetuating attitudes of colonialism. While I’ve been thankful for the heavy moderating and redirecting influence my mentor Jean has had on this project, the only suggestion I can make is this: I hope that by illustrating ways in which Western epistemologists are finally acknowledging realities that Aboriginal scholars identified a long time ago, we can become stronger allies, more equal collaborators, and life-long learners alongside Indigenous friends.

V. References

From theory to practice: developing the preconditions for group creativity

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Abstract - Enterprises seeking competitive advantage often turn to creativity to enhance the problem-solving ability of their teams. Cultivating an atmosphere that is conducive to creativity ensures that when step-by-step problem-solving recipes are implemented, the best result emerges. These preconditions include autonomy, intrinsic motivation, freedom to fail, positivity, planning and creative skills. In order to move beyond theory to practical application of creativity enhancement, exercises are proposed that directly target each of these characteristics, improving the team environment and increasing the probability of creativity. An experiment was conducted to determine the correlation between the existence of these preconditions in the group and the group’s creativity, and between the precondition and the activity chosen to represent it. Next steps and further applications of this research are discussed.

I. Introduction
Creativity is defined as, “the production of some novel result that is useful, tenable or satisfying, and represents a real ‘leap’ away from what has previously existed.” This ability to advance is valuable to organizations as a key component of competitive advantage in all industries. Much exploration has been conducted on creativity of the individual. Other research has explored how the environment an individual works in can affect their work. However, the prevalence of teams and groups in organizations today requires that research move beyond the individual to consider how social creativity is impacted by its environment.

An environment that is rich in the preconditions for creativity is an important prerequisite for the effective use of specific tools for problem solving. A useful analogy is of that of growing a new plant, where both the soil around the roots and the stake supporting the seedling facilitate growth. The focus of this research is the “soil conditions” of the seedling that is “group creativity.”

The preconditions of creativity used in this study were taken from books in popular culture. Lists of characteristics of creative groups were documented from these works and then clustered to create six hypothesized preconditions for creativity: autonomy, positive emotion, intrinsic motivation, freedom to fail, planning, and creative skills.

II. Methods
Once the preconditions were chosen, activities were selected to target each one. A questionnaire was created to determine the change in the levels of the six preconditions before and after the activity. The questionnaire involved questions on a five-point Likert scale, and open-ended questions. The researcher coded the open-ended questions after all sessions were complete, using a 5-point scale.

A creativity assessment based on the Guilford Alternative Uses task was chosen to represent the creativity of the group. This task was scored along the fluency dimension, which is the total number of responses given to the question.

Each session was conducted in groups of four. There were seven sessions: one group for each precondition and a control group. The groups were given the introductory questionnaire, then the entrance creativity assessment. Next, the activity was administered. The group then performed the exit creativity assessment followed by the exit questionnaire.

Group scores in each precondition were calculated by aggregating responses across all group members. This was done for both the entrance and exit questionnaires. The difference in
the aggregate scores showed the change in each precondition within that session. These differences were summed to show the overall change across all preconditions. The group fluency measure was calculated for both the entrance creativity assessment and the exit creativity assessment, and the difference between them showed the overall increase in creativity.

III. Results

Three aspects were considered when looking at these data. First, the relationship between the activity and its target precondition was examined. Then, the correlation between change in overall group score of the preconditions and the creativity score was analyzed. Finally, the change in each individual across all activities was correlated with the creativity score.

The precondition selected for intervention did not show a unique increase after its targeted activity. (Table 1)

The change in overall group score in the preconditions showed no correlation with the group creativity scores (Table 2).

The difference in scores of each of the preconditions was correlated with the differences in creativity scores within each session (Table 2). Many preconditions had no correlation. Positive correlation coefficients of small significance were found between positive emotion score and creativity score, and planning score and creativity score. A positive correlation coefficient of medium significance was found between intrinsic motivation score and creativity score. A negative correlation coefficient of medium significance was found between creative skills score and creativity score.

The measures of the preconditions were correlated with creativity across activities in order to observe the correlation between what group members actually felt and their creativity, instead of what they were expected to feel and their actual creativity.

The expectation was to see a positive correlation between changes the preconditions and creativity. However, the results from the study are inconclusive. Further research with further control would be required to draw stronger conclusions.

IV. Discussion

This study was created to move from theoretical recommendations to practical applications. A number of assumptions were required to be able to conduct a practical experiment. Further iteration could reduce these assumptions for clearer results. This discussion focuses on the connections assumed, measures used and the sample studied.

There were two major assumptions made in this research. First was the connection between the preconditions and creativity, and second was the connection between the activities and the targeted preconditions. The relationship between the preconditions and creativity requires further validation from experimental literature, as they were selected from observational evidence from popular culture. The relationship between the

<table>
<thead>
<tr>
<th>Activity</th>
<th>Targeted precondition</th>
<th>Precondition with greatest change</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Autonomy</td>
<td>Positive Emotion</td>
</tr>
<tr>
<td>B</td>
<td>Intrinsic Motivation</td>
<td>Planning</td>
</tr>
<tr>
<td>C</td>
<td>Positive Emotion</td>
<td>Planning</td>
</tr>
<tr>
<td>D</td>
<td>Freedom to Fail</td>
<td>Positive Emotion</td>
</tr>
<tr>
<td>E</td>
<td>Planning</td>
<td>Freedom to Fail</td>
</tr>
<tr>
<td>F</td>
<td>Creative Skills</td>
<td>Positive Emotion</td>
</tr>
<tr>
<td>G</td>
<td>Control</td>
<td>Planning</td>
</tr>
</tbody>
</table>

Table 1: Relationship between activity and targeted precondition

<table>
<thead>
<tr>
<th>Activity</th>
<th>Creativity Score</th>
<th>Autonomy</th>
<th>Positive Emotion</th>
<th>Intrinsic Motivation</th>
<th>Freedom to Fail</th>
<th>Planning</th>
<th>Creative Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>12</td>
<td>26</td>
<td>5</td>
<td>8</td>
<td>3</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>B</td>
<td>11</td>
<td>21</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td>5</td>
<td>7</td>
</tr>
<tr>
<td>C</td>
<td>22</td>
<td>32</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>7</td>
<td>12</td>
</tr>
<tr>
<td>D</td>
<td>36</td>
<td>19</td>
<td>-2</td>
<td>7</td>
<td>4</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>E</td>
<td>15</td>
<td>15</td>
<td>-2</td>
<td>3</td>
<td>1</td>
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<td>4</td>
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<tr>
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<td>11</td>
<td>3</td>
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<td>7</td>
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<tr>
<td>G</td>
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<td>13</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>7</td>
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</tbody>
</table>

Correlation Coefficient

<table>
<thead>
<tr>
<th></th>
<th>OVERALL</th>
<th>Autonomy</th>
<th>Positive Emotion</th>
<th>Intrinsic Motivation</th>
<th>Freedom to Fail</th>
<th>Planning</th>
<th>Creative Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correlation Coefficient</td>
<td>-.04</td>
<td>-0.03</td>
<td>0.13</td>
<td>0.53</td>
<td>0.04</td>
<td>0.12</td>
<td>-0.52</td>
</tr>
</tbody>
</table>

Table 2: Correlations between group precondition scores across activities and creativity scores.
preconditions and the activities should be strengthened through focused experimentation on how activities affect the preconditions in individuals and groups.

The measures that would improve this study are those used to evaluate the preconditions in the group and those used to evaluate the creativity of the group. The evaluation of the preconditions could be improved by using established tests for each. Only self-report measures were used in this study, so individuals may have misunderstood or been misled by the questions. The Big Five personality test and Self-Determination inventories are one way this could be tested. The method of evaluating creativity could be improved by using all four dimensions of evaluation on the Guilford Alternative Uses Task, or by using a wide variety of tasks to triangulate an accurate creativity score. The usual dimensions of evaluation are fluency, flexibility, originality and elaboration. Fluency was chosen for this study due to the method used to record responses. Handwritten notes were taken quickly to capture all the responses, leading to shortened responses. Guilford’s Alternative Uses Task was chosen for this assessment due to familiarity and resource restrictions, and a battery of tests administered by professionals would measure creativity more accurately.

Finally, the sample used for this study shows several biases. The majority of the participants in this sample were previously acquainted with each other. This sample of participants was more familiar than average with the creativity assessment method used due to common classes, which may have had unknown effects on the results. In addition, each precondition was tested only once with one activity. Time and resources constrained this experiment from recruiting a larger sample, and requiring four individuals per session was a logistical challenge that would benefit from a larger group of researchers, a more extensive recruitment plan and higher remuneration for the participants. Multiple sessions for each precondition using the same activity would increase the validity of the results.

V. Conclusion

This study returned inconclusive results that did not support the hypothesis that an increase in these preconditions would show an increase in overall group creativity. However, this area is worth pursuing further with a more controlled procedure, for a better understanding of creativity in groups. Further application could be in retreats designed for pre-formed groups to participate in, or an exploration of the relationship between creativity and the “twenty percent time” for personal projects that some organizations implement. In all cases, tilling the soil to ensure optimum creativity preconditions can only serve to improve quality of work and of life for all involved.

VI. References

Language Disorders and the Genetic Basis of Language

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Abstract - Many developmental Language Disorders have a biological basis. As a result, researchers turn to Language Disorders for insight into the genetic foundation of Language. This paper will address the utility of Language Disorder research through case studies on Specific Language Impairment, Non-specific Language Impairment and William's Syndrome. Understanding the genetic cause of these Language Disorders is simply a starting point: further research on the role of compensatory mechanisms, gene interactions and neuroanatomical changes in these disorders will lead to the refinement of diagnostic tools, and to a better understanding of Language itself, how it develops in an individual, and how it evolved.

Only Humans communicate using Language: a rule governed system of arbitrary symbols that can be combined to convey an infinite number of ideas1. We begin to acquire Language before birth and are able to communicate in full sentences by a young age. We receive no formal instruction, yet normally developing (ND) individuals learn Language effortlessly.

A subset of the human population, however, must work to acquire Language. Whether they have syntactic, morphological, phonological, lexical or pragmatic deficits, individuals with Language Disorders struggle to communicate with those around them.

Some researchers view Language Disorders as a window into the Language Development process. They see Williams Syndrome (WS) and Specific Language Impairment (SLI) as evidence of a double dissociation between Language and Cognition. They discover a speech impairment caused by a mutation in the Foxp2 gene and treat the disorder as a natural gene deletion experiment. Though Language is a complex phenomenon, unlikely to be governed by a finite set of genes, comparing different Language Disorders provides insight into the foundations of Language.

Language and Cognition

The domain-specificity debate is central in Language Research: domain-specific learning mechanisms would indicate that part of the genetic code prepares children to learn Language. One test of this theory is the existence of double-dissociations: if, for example, Language ability can be impaired in the absence of Cognitive deficits and vice-versa, it is likely that the two abilities are acquired via different mechanisms. SLI and WS are often cited as evidence of such a double dissociation, though researchers increasingly agree that the picture painted by these disorders is far more complex.

Individuals with SLI have approximately normal IQs but score below a threshold level on the Rice-Wexler Test of Early Grammatical Impairment2. By definition, these individuals have no hearing problems, cognitive deficits or neural damage. The cause of SLI is unclear, but twin studies and family studies indicate the disorder has a genetic basis3.

In many respects, WS is the reverse of SLI: those with the disorder have surprisingly large vocabularies and strong language abilities despite having an IQ between 40 and 85. WS children are have strong verbal memories and their language is often described as “intact” or unaffected by their cognitive deficit4.

Although these disorders are often cited as examples of the double dissociation between Language and general cognitive ability, neither profile is as clear as it first appears. There is, for example, debate over the accuracy of the definition of SLI, as there appears to be overlap with another disorder: Non-specific Language Impairment (NLI). The two groups differ only in IQ: in contrast to those with SLI, individuals with NLI have IQs
between 70 and 85\(^5\). Many researchers now argue that SLI and NLI appear to be in the same ‘natural class’ of disorders\(^5\). If this is true, then SLI is not a pure example of dissociation between Language and Cognition, although it shows that Language can be less impaired than Cognition when both abilities are affected by the same genetic mutation.

Similarly, research on WS reveals that the Language of these individuals is not intact. WS children have larger expressive than receptive vocabularies indicating that, unlike their ND peers, they use words before they understand their meaning\(^6\). They also over-regularize irregular verbs\(^7\) and struggle to correctly use gender agreement morphemes\(^4\).

The relationship between Language and Cognition observable in WS and SLI is complex. Further study will be necessary to understand the way these abilities are related to each other.

**Genotypes and Phenotypes**

As researchers investigate the characteristic deficits of Language Disorders, they also attempt to determine their cause - often a genetic mutation. Intuitively, it is simple to conclude that a mutation directly causes a particular phenotype. However, a single gene influences many aspects of development -- genes encode the ‘blueprint’ of proteins, which in turn act throughout the body. Consider, for example, the neuroanatomy of individuals with Language Disorders.

Typically, the left perisylvian region is dominant for language and larger than the homologous region on the right\(^3\). In SLI individuals, the left perisylvian region is the same size, if not smaller, than the right hemisphere structure. Some individuals with SLI also have an abnormal sulcus in Broca’s area\(^8\). Though these structural abnormalities are not thought to cause the Language Impairment, they could be a byproduct of the mutation.

Changes in neural anatomy are also observed in WS. The cerebrum is small, and the amount of neuron myelination is reduced\(^4\). From the moment of conception, the brains of individuals with WS develop differently. Thus, even if their language is remarkably intact, it is unlikely that they acquire it in the same way as their unimpaired peers.

**A gene for language**

In the 1990s, a family was discovered in Britain\(^3\), several members of which struggled to understand identify grammatically incorrect sentences and acquire normal morphology\(^9\). All affected family members shared a common nucleotide substitution on chromosome 7 at q31. This nucleotide substitution results in an amino acid substitution in the FOXP2 transcription factor, creating a non-functional protein\(^10\). Individuals with the mutation have low levels of grey matter in Broca’s area\(^11\). However, the precise nature of the impairment correlated with the Foxp2 gene mutation is unclear: while some argue that Language is directly impacted by the mutation, others argue that the primary deficit is one of orofacial muscle control\(^10\). Though the Foxp2 gene may contribute to normal Language development, it is not simply a gene for Language: during embryonic development, the FOXP2 transcription factor is also expressed in the lungs, heart and gut as well as the developing brain\(^10\). It is clear that this mutation has a system wide effect.

The products of a gene can impact development directly, indirectly by facilitating the development of a trait, or by preventing an antagonistic factor from acting. Natural gene deletion experiments, such as those seen in Language Disorders, can show that disruption of the gene’s normal function negatively impacts an ability\(^3\) – but they do not prove that the intact gene directly causes normal acquisition of the ability.

**Value of the Research**

Understanding the genotype of a Language Disorder is a starting point - it is through further research that clinicians develop better treatment methods, geneticists gain information about the evolution of the human brain and linguists learn about the origins of Language.

Consider, for instance, the role Broca’s area plays in Language processing. Broca’s aphasics, who have brain damage in the region, have syntactic deficits. Individuals with the Foxp2 mutation and Broca’s aphasics score similarly on tests of grammatical competence, including tests of verbal and derivational morphology\(^12\). As discussed earlier, individuals with SLI and the Foxp2 mutation both show abnormalities in Broca’s area.

The above similarities are more interesting in light of cross-species studies. The Broca’s area homologue in monkeys is thought to contain Mirror Neurons which activate when an action previously performed by one individual is perceived or
performed by another individual. One theory stemming from this work is that the primary deficit associated with the Foxp2 mutation is an inability to imitate the actions of others. Thus, research on these disorders contributes to the body of knowledge about this crucial language area.

Research on Language Disorders also has important implications for treatment. Many Disorders, such as SLI, can only be diagnosed after age 4 because the early warning signs of the disorder closely resemble late ND Language Acquisition. Delayed Language Acquisition often requires no treatment as the observed deficits will correct themselves while disorders like SLI require clinical intervention. A better understanding of both the genotype and phenotype of Language Disorders can lead to earlier diagnosis and thus earlier treatment.

Even in the absence of treatment, the human brain has the ability to compensate for some of the damage caused by genetic mutations. In the case of WS, individuals somehow achieve high Language competency. fMRI studies have shown that WS individuals devote larger areas of their brain to Language Processing than their ND peers, and some have suggested that ND individuals acquire their first language more like a second language - through memorization rather than knowledge of grammatical rules. Studying the way the brain compensates for different impairments provides researchers with insight into the way the brain develops.

Conclusion

Language is a complex human ability. It is unlikely that researchers will ever discover a finite set of genes responsible for Language Acquisition, as this phenomenon appears to be the result of multiple genes and their products. Regardless, there is considerable value in this research, as it may lead to the refinement of diagnostic tools, and to a better understanding of Language itself, how it develops in the individual, and how it evolved.

References

Sustaining ecological integrity, culture, and recreation through improved integration of parks and trails

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Abstract - With increasing urbanization and environmental degradation arises the need to address our impact on our environment. Urban parks and trails have the potential to solve problems of disconnectivity between habitat patches that threatens the integrity of urban ecosystems by creating ecological corridors. They also provide an avenue for cultural events and recreational activities which helps build strong communities. Greenway implementation and concepts of reconciliation ecology are strategies to achieve these integrated systems. Using a short section of the Iron Horse Trail in Kitchener as a case study, I was able to compare the current situation with the City’s plans and strategies to assess its efficacy. The City recognizes the relationship between environmental and humans needs, however it does not directly plan towards their reconciliation.

I. Introduction
In our increasingly urbanized world, there is a need to find strategies that will address the impacts of urbanization and accommodate development in an ecologically sensitive manner (1). Urbanization brings significant conservation challenges especially through habitat fragmentation and destruction (2). Many of the threats to biodiversity loss are related to public services and infrastructure, of which city governments are directly responsible (3). An underlying cause of policy-making issues may be that urbanization separates humans from nature. Understanding this relationship is important since societal decisions and human behavior are the direct drivers of the land use change (4). Seeing nature and culture as separate categories creates relationship between humans and their environment as masters over nature or as its keeper (5) rather than integral components of ecosystems. Unfortunately, this conception of nature does not coexist very well with cities and makes urban biodiversity conservation appear inconceivable.
The purpose of this paper is to find ways to improve planning strategies that mitigate the problems associated with our increasingly urbanized world.
In particular, the use of greenways - networks of linear elements that are planned, designed and managed for multiple purposes such as environmental and cultural protection (1,6) - will be investigated. Adopting concepts from reconciliation ecology, I am looking for ways to take advantage of the relationship between environmental and human needs. By facilitating sustainable modes of transportation and increasing habitat connectivity, the linking of greenways, city parks, and trails may serve to link biodiversity with socio-cultural diversity. The main objective is to discover how to sustain ecological integrity, culture, community, and recreation through improved integration of parks and trails.
The following questions will be investigated:
Can an effective transportation network based on cycling coexist with healthy urban ecosystems?
Can and should greenways be multi-functional?

II. Results
1. City Plans
The City is in the process of writing and approving many different plans concerning its parks, trails, community, and culture. Those selected for analysis include the Parks Strategic Plan, Sustainable Urban Forest Plan, Strategic Plan for the Environment, Community Trails Master Plan Draft, and the Cultural Plan. The following themes were gathered.
1.1 Linkages
Conserving natural corridors is stated as an objective (8), but there are no concrete management strategies offered for how to achieve this, never mind creating new corridors or greenways. The parks’ situational analysis is pessimistic about linking the existing natural areas with other
surrounding natural areas, stating that “given the urban context, level of development and presence of major roads, this is unlikely to change” (9).

1.2 Reconciliation
The possibility of a coexistence between trails and natural areas is recognized to be compatible in some cases, however in other cases it is not (14). Caution is advised around sensitive environmental features and narrow, constrained wildlife corridors (14). However, encouraging statements are that “healthy parks = healthy people” (8) and that “humans are part of the ecosystem in which they live” (13).

1.3 Biodiversity Planning
The threat of Emerald Ash Borer (EAB) highlights to what degree time is an issue for the implementation of biodiversity planning. The EAB issue was first brought up to Council in 2004 (11), positively identified in south Kitchener in August 2010 (12) and a first draft of a plan to take action will not even be developed until mid 2012.

1.4 Cultural Planning
The City plans to integrate facilities and open spaces that support special events and a wide range of cultural activities in park design (8). The Public Art Program features maps of the city highlighting public art displays and encourages citizens to talk, walk, cycle, and reflect on the history and creativity of arts in the region. The Kitchener Industrial Artifacts Project presents historical artifacts along trails to have citizens reflect on the human-made landscape of the region (15).

1.5 Collaboration
The city prioritizes community involvement and cross-sector collaboration in decision-making with the first guiding principles being partner, support, and collaborate (13).

2. Case Study
With a case study of a trail segment in Kitchener - a city with a population of 223,715 and 115 km of trails amid about 1,519 hectares of parkland (7,8) - and information gained from personal correspondences with City of Kitchener staff, I compared the planning issues of the case study with academic literature to assess the location.

Located near the downtown core of Kitchener, the stretch of the Iron Horse Trail studied begins at Raddatz Park, then intersects with one of the city’s main roads, Victoria St. Further East, it borders the Henry Strum Greenway before a junction leading to Victoria Park. The trail then crosses Queen St., another important road. The entire route measures about 1.6 km. Though it appears well connected on the map (fig. 1), it is fragmented by roads and private properties. There is certainly room for improvement at street intersections and need for improved signage, two issues identified within the City’s plans.

The city’s culture is well represented with a bull gear dating from 1908 located near Cherry St. and a modern creation named Bike DNA painted directly onto the trail’s pavement. Diversity of green space is also present, with a greenway, natural area, and park bordering the trail. Despite their adjacent location, it is nearly impossible to guess the presence of Raddatz Park and Natural Area from the trail. To access the park, you must follow the contour of a barrier for about 20m on Gage Ave. as there is no sidewalk. It is also unclear whether the natural area should be accessible or if it needs to be conserved. The City has identified the need for improved signage and wayfinding aids and made it part of the trails plan short term goals, meaning that it would take between 0-5 years to implement. It has been about a year since then, so it’s a little early...
to assess how well this part of the plan will be executed. From the Iron Horse trail, there are also a number of accessible points of interest. The Joseph Schneider Haus museum, Boathouse restaurant, City Cafe Bakery, and Nougat commerce all contribute to the local culture and should be included in the City’s listing of cultural amenities. Small enterprises and museums such as these benefit from a trails network that increase their accessibility.

III. Discussion

The fragmentation of the parks and trails network not only affect habitats, but also recreational, and socio-cultural purposes. Greenway implementation may help, but they are difficult to plan for because their benefits vary from case to case. There are already instances where they coexist with trails, such as the Henry Strum Greenway and the Iron Horse Trail in Kitchener, and where cultural evidence such as the Industrial Art Project and CAFKA exhibits is represented as well. An intersection of species habitat and human needs (aesthetic, educational, cultural, and recreational) can be found where the benefits of urban greenways are realized (1). However, especially with the debate surrounding the benefits of greenways, a full assessment of the natural areas nearby is required to determine whether their ecological integrity is compromised. The City’s plans seem to recognize the potential for reconciling many needs with one strategy. The connection is made between healthy parks and healthy people, and humans are recognized as part of the ecosystem in which they live. However, it does not yet plan to advance both goals at once. In fact, planning to benefit the community exceeds planning for biodiversity and the City displays two of the three main problems that hinder planning for biodiversity. First, there are inadequate compilations of ecological data and terminology confusion (4). Despite having the knowledge of natural area connectivity benefits, it has not quite been translated in the City’s objectives. Like previous plans, there is still no apparent standardized approach to the data collection, organization and management of these areas, nor any guidelines for prioritizing natural areas for management plans (9). Urban form, sustainability, and trail terminology are still unclear. Second, there is a lack of methods that take into account the risks and opportunities from land use changes, including the time scales (4) such as the slow response to the EAB issue. Third, and most encouraging, is that the City does not appear to experience difficulties between the increasing number of people participating in the planning process (4). The City seems to be effective in informing the public about its plans with methods such as open houses and quick replies to citizen emails.

Overall, if the suggestions from the City’s plans are eventually to be effectively implemented, the future connectivity of parks and trails and its benefits to the community seems promising. The effect this will have on biodiversity is uncertain, as it isn’t really being prioritized. Hopefully this will change as the community gains more access to interact with urban nature and becomes more educated about their environment.

IV. References

Performatve Polyphony in Crisis Time

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Abstract - The work of the Russian literary philosopher and theoretician M. Bakhtin has attracted intense interest over the past thirty years. However, his particular theories, if they can even be termed theories, continue to present problems and challenges in literary analysis. In particular, Bakhtin’s theory of literary polyphony is a notoriously difficult analytic tool. Polyphony, a neologism chosen by Bakhtin, immediately recalls the term’s musical heritage. Several critics, including Malcuzynski, Wall and Benson, have examined the meaning transfer caused by this musical connection. However, literary polyphony is primarily a theory of the creative process according to Morson and Emerson. As such, polyphony in a novel is more closely related to the performance of a piece of music rather than to the physical manifestation of the score. Both types of polyphony are thus examples of utterances in the rich Bakhtinian sense of the word. Polyphony arises through the dialogue between an author and his or her hero/heroine; a dialogue that is animated by the crisis points experienced by the hero/heroine. These crisis points significantly take place on the boundary or threshold of the public square. Bakhtin placed particular emphasis on this aspect of the polyphony in Dostoevsky’s novels in Problems of Dostoevsky’s Poetics. Two novels by Tahar Ben Jelloun, L’enfant de sable (1985) and La nuit sacrée (1987) which contain a total of eight narrators, effectively illustrate the importance to polyphony not only of multiple and independent voices or consciousness, but of a new conception of time and space.

In 1961, Mikhail Bakhtin wrote with surprising incisiveness, “Consciousness is much more terrifying than any unconscious complexes” (TRDB 288)¹. This statement, referring to the innovative aesthetics of Dostoevsky’s novels, provides an unexpected counterpoint to Freud’s canonic division of the mind. The nature of consciousness interested Bakhtin throughout his career and is central to his theory of polyphony in the novel. The terror of consciousness, which excludes the possibility of an inaccessible substrata, tacitly dominates the narrative process in L’enfant de sable (1985) and its continuation La nuit sacrée (1987), two novels by the French-language Moroccan author Tahar Ben Jelloun who was awarded the Prix Goncourt for the latter. These texts contain the story of the eighth child of a wealthy merchant in Marrakech. Born a girl, the child is raised as a boy and accorded the incumbent privileges of an heir in the strict patriarchal and Islamic society of Morocco. After the father’s death, his heir, Ahmed/Zahra, begins to accept and experiment with his/her feminine identity by escaping from the silent oppression of the parental home. In L’enfant de sable, the narrative thread is shared by seven distinct conteurs who take up the burden of narration as a performance in the public square or Halqua (‘round table’) of Maghribi culture. Ahmed/Zahra reappropriates her narrative in La nuit sacrée by becoming the eighth and final conteur. Bakhtin’s theory of literary polyphony of independent and unmerged consciousnesses is intimately connected to performance and to the creative act. Though multiple narrators are not solely sufficient for Bakhtinian polyphony, Ben Jelloun’s novels provide a unique narrative performance that can be read experimentally as contemporary polyphony.

Bakhtin coined the term “polyphonic novel” to describe the new novelistic genre exemplified by Dostoevsky’s work and described polyphony as “A plurality of independent and unmerged

¹ The following abbreviations will be used for Bakhtin’s major works: Problems of Dostoevsky’s Poetics (PDP) and Toward a Reworking of the Dostoevsky Book (TRDB).
*consciousnesses*” (PDP 6, Bakhtin’s emphasis). Polyphony is often conflated with the similar, but separate, concept of heteroglossia. Heteroglossia is concerned with the diversity of speech styles in language while polyphony describes the relationship between an author and his or her heroes in a literary work. However, heteroglossia finds greater expression in polyphonic novels than in their monologic counterparts (PDP 82). Each voice in a polyphonic work must be a unique point of view on the world, a unique ideology. Bakhtin provides information on polyphony by employing a haphazard and exploratory method. The result is a varied and divergent response in the critical literature. Different points are emphasized by each critic leading to a variety of views on what constitutes contemporary polyphony and its expression in the twentieth-century novel.

Three critics in particular have examined the metaphorical meaning transfer from musical polyphony to literary polyphony. M.-Pierrette Malcuzynski, Anthony Wall and Stephen Benson all treat polyphony as a formal technique contained within the polyphonic novel. Malcuzynski examines polyphony as a literary technique within contemporary narrative theory and provides several examples of texts where polyphony is used. Wall, on the other hand, takes a global view by considering not just well known terms like polyphony and voice but also tone, intonation, orchestration and dissonance among others. Wall also focuses on the characteristics of the literary voice within a polyphonic structure and stresses the importance of listening to the silence created in the conceptual space between voices (66). Finally, Benson’s approach is narratological in nature. His goal is to clarify the application of poststructural narratology to musical forms by bridging the gap between the methodological paradigm and the object of study (musical texts). Like Malcuzynski and Wall, Benson treats polyphony as a formal aspect of a static text while Morson and Emerson value its role in the creative process. For the latter critics, polyphony operates not on the level of a finished text but at the very locus of creation.

This position raises the question of Bakhtin’s intention when he chose the word “polyphony” above “multi-voicedness” or some similar neologism and his motivation as he swiftly cautioned against reading too much into this metaphor (PDP 22). Many discussions of literary polyphony focus on the mechanics of the metaphor; however, the fundamental linkage occurs at a level above these mechanics. In Dostoevsky’s creative process, the author engages in dialogue with his heroes as he writes the novel. This dialogue lives in the moment of composition or writing. It comes into existence and is lost into the great dialogue of the world in a process that makes Dostoevsky’s novels fundamentally different to everything that came before. In fact, Dostoevsky’s creative process more closely resembles the performance of polyphonic music or of any music for that matter rather than the act of musical composition. Musical performance lives in the instant. In the same moment, musical polyphony is created and lost forever with the same sense of unbounded potential that characterises true Bakhtinian dialogue.

A musical performance can be thought of as an utterance in the rich Bakhtinian sense of the word. A musical score is equivalent to the sentences that make up utterances. “Sentences are repeatable. […] But each utterance is by its very nature unrepeatable. Its context and reason for being differ from those of every other utterance, including those that are verbally identical to it” (Morson and Emerson 126). This description of an utterance can be applied word for word to a musical performance. In Bakhtin’s theory of the novel, the mirror image of a musical performance, albeit refracted to some extent, is not the physical text of a polyphonic novel, but the instant when the text was written: the instant when the author was engaged in dialogue with his heroes. Creation and dialogue occur together. The polyphony metaphor can be effective and convincing by locating the essential linkage in the temporal zone of the present in musical performance and of polyphonic writing. Dialogue and performance are utterances fully conceived in the instant of their creation. Bakhtin’s polyphony loses none of its force for unbinding itself from the term’s musical heritage.

Successfully applying Bakhtinian polyphony to contemporary texts can be a difficult business. In the case of Tahar Ben Jelloun’s novels the problem is two-fold. Firstly, polyphony is a notoriously unwieldy analytic tool to use convincingly since the only works Bakhtin explicitly identified as polyphonic where those by Dostoevsky; though he did state that other polyphonic novels existed. Serious applications of polyphony to contemporary novels often fall victim to the obscurity of the texts
themselves (see Malcuzynski 1983, 61-64) or tend to be too technical by focusing on syntax and grammatical constructions that sound decidedly un-Bakhtinian (see Teranishi). The second problem is the thorny issue of imposing a European theory on an African or Maghribi text: a process that inevitably summons the spectre of colonial thought and practice. Nasrin Qader compellingly refutes the latter charge by arguing that neither theory nor literature should be privileged over the other since each informs the other to challenge assumptions and secondly that literature rarely falls within firmly demarcated political lines (Qader 195, note 10). Though Ben Jelloun’s choice of subjects, themes and language have been criticised, as a dual citizen of France and Morocco he exemplifies the universality of a literature that defies the constraints of an single ideology.

Ben Jelloun’s two novels draw heavily from the oral tradition of the Maghreb allowing multiple narrators to pick up the thread of the récit. The result is the singular event of a story told in the public square: a performance born of the crisis engendered by the misfortunes of the hero/heroine. This intermingling of voices strongly suggests polyphony on the surface. However, Bakhtin polyphony is an essential characteristic of Dostoevsky because it “demands a different conception of time and space” (PDP 176). This space is both the public square where the performance takes place and the threshold or borderlines where crisis time significantly impacts the hero.

The public square is particularly important in L’enfant de sable. The first two conteurs who together cover the first half of the book narrate the récit in a public square in Marrakech. However, the narration is pushed from the square by the urbanist aspirations of city officials (which constitutes a crisis point in the narrative):

le fil de cette histoire qui les [les membres de l’assistance] réunissent s’est rompu. En fait le conteur, comme les acrobates et autres vendeurs d’objets insolites, avait dû quitter la grande place que la municipalité, sous l’instigation de jeunes urbanistes technocrates, a « nettoyée » […]. La place est propre. (Ben Jelloun 1985, 135)

This rupture in the narrative emphasizes the polyphonic character of the novel and of the récit. Similarly, the critical and final crisis point in La nuit sacrée occurs in the stairwell and doorway opening onto the square: “Arrivée à un mètre de l’oncle, je lui tirai tout le chargeur dans le ventre” (Ben Jelloun 1987, 140). Ahmed/Zahra liberates herself from her struggle for identity by cutting the last link to her old life. These crisis points that take place on the threshold confirm the polyphonic quality of the novels. The dialogue of the creative act doubles as an identity-forming formativ for Ahmed/Zahra. Bakhtin described polyphony as he experienced it in works from the end of the nineteenth century. Though contemporary polyphony is difficult to distinguish definitively, it retains the force of a transformative innovation in the history of the novel.

References
Mediums and Messages: The Evolution of Communication from Thought to Tweet.

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Abstract - Any shift in communication leads to changes within ourselves, our relationships and our connection to the world. As communication evolves, it completely changes the way we live our lives. In the 1400s when Johannes Gutenberg invented the printing press, people, society, and the relationships within, radically evolved. Currently we are experiencing another major shift in communication through online realms, social media, and instant messaging. The Internet and online spaces have evolved to transform communication once again. These shifts in communication bring about major changes in human interaction and the functions of society. The many mediums we use in communication influence our connections, encounters, and our overall relationships. Marshall McLuhan’s coined phrase, ‘the medium is the message’ 7 remains true today. In our immersive world, the many mediums with which we choose to interact or communicate influence the end message. Each tool or form we use in communicating sends a new message, which affects the outcome. When we change how we communicate with others, we are changing how we interact with them. Understanding the mediums we use is essential to understanding ourselves, our relationships and the world around us.

I. Introduction

When communication changes and develops, it affects the way we relate to ourselves, others and environments. Communication has transformed from thought, to oral language, to manuscripts, to the printed book, and now to online realms. Looking at these evolutions can help us understand ourselves, relationships and the world around us.

After the printed book was invented, communication became a mass produced entity. The book was a product of the individual - leading to the Western ‘I’, “yet it was the first product of mass production” 1. Gutenburg’s printing press reinvented communication and in turn changed society. Knowledge, for the first time, became available to the masses at a low cost. As the use of the book and newspaper spread as a method of communication, people were disturbed by its new format. For some people, the invention of the book diminished the value of knowledge by extending it to so many minds. Even the mediums we are familiar with today, such as printed texts, were not accepted as they originally evolved 1.

Now once again, we are experiencing a major shift in communication that is not readily accepted as a new approach to communicating. A large majority of our communication occurs in online spaces. With the development of computers, the Internet and various other technologies, our communication methods have completely transformed once more. McLuhan was able to point this out back in the sixties when technology first began to expand. Although his publications were far from the online outbreak, “[m]uch of what McLuhan has to say makes a good deal more sense [now] than it did in1964 3”. He warned the world about expanding technologies and pointed out the influence and power of new communication forms.

Over the years the act of note taking and writing formed its own craft. There is a skill and technique involved in handwriting that is unique to other communication forms. It is important to recognize new forms of communication as being different and not replacements of older methods. Handwritten communication generates a different experience than any other. Since they have
different outcomes and experiences, each method can serve an entirely different purpose.

II. Holiday Study

As the spectacle of technology expands, other forms of communication may be forgotten. Many of us may go years without needing to buy a stamp or visit the post office. With the ease and speed of the Internet, the process and craft of handwritten notes and post-mail has diminished. The new shift in communication has phased-out and overshadowed the use of handwritten communication. We need to recognize these changes and understand the differences between all possible methods of communicating.

The Holiday study examined how people related to a particular method of communication. Understanding the medium is essential to understanding communication and how it shapes our relationships. The purpose of the study was to obtain personal responses to a physical, written mode of communication and to gather data relating to people's opinions of physical mail. The study explored how people responded to handwritten, post-mailed communication. Participants were asked questions about their initial response to the medium and their previous experience with the exchange.

30 friends, and relatives varying in age, gender, and location were sent Holiday cards. The Holiday cards came with an optional survey of the same medium to complete and mail back. Of the 30 possible participants, 17 opted to complete and mail back their survey.

Study Results

Many of the results for the Holiday study were inconclusive. Several questions had varying answers across all possible options. With such a wide range of participants in age, gender and location this outcome was expected.

With a total of 16/17, participants said, ‘Yes, they enjoyed receiving physical mail’. The reaction to the medium overall was very positive. 15/17 claimed they keep cards, greeting or letters always or often. Likewise, 15/17 participants said they expected to keep the greeting card I had sent them for months to years. There was a clear nostalgia and possession over the personal cards that may not be present in other forms of communication.

The reaction to the medium did not always match up with their experience exchanging physical mail. Answers were split between whether or not participants had received other Holiday cards, (9, yes; 8, no). An even higher number, (10/17) said they did not plan on sending any card this year. Despite the enjoyment people claimed to get when receiving physical mail, less than half intended to send anything themselves. For 9 people it had been months to years since the last time they physically mailed a letter, card or greeting. The reasoning all varied between time to write, time to mail, cost of supplies, cost of postage and access to addresses. Many other answers were given such as apathy and laziness, not knowing what to write, difficulty finding mailboxes, and wanting a proven record when corresponding. Participants added that e-mail was fast, easy and allowed for quicker replies.

III. Mediums and Messages

Mediums and Messages is a participatory installation event to be held in the Environment 2 building at the University of Waterloo. To understand ourselves, our relationships and the world around us, we must be aware of the mediums we use to communicate. McLuhan said, “It is the medium that shapes and controls the scale and form of human association and action”\(^5\). Each medium is a new form that creates an entirely new message. Examining the content it provides will tell you far less than what the medium itself can say. The Mediums and Messages project examines various mediums and how people interact with them. Event participants can explore the mediums that change our lives by thinking, communicating, and expressing.

The event investigates the evolution of communication by allowing visitors to interact with 6 separate mediums. Although all of the stations look at encounters, each focuses on a different medium of communication. The stations are as follows,

Tweet: In 140 characters or less, describe the most significant encounter you have had in your life so far. Restricting ourselves to 140 characters has become a common practice among many. What happens when we are forced to communicate our deepest thoughts through this medium?


**Face:** *Encounter yourself. Take a picture, post it in front of you, and describe the present you in the photograph.* For many years now Facebook has facilitated and encouraged looking. How is this glimpse of your present-self similar or different to the looking you do in various mediums online?

**Type:** *Detail a place you would rather be and explain what you have encountered there.* The printing press established mass communication and revolutionized knowledge itself. Computers have allowed us to fix, change and correct our work, but what happens when your medium no longer supports editing?

**Write:** *Handwrite a letter or message to someone you have encountered in your life that you are currently unable to speak with.* Though increasingly an uncommon practice, sending a physical letter or handwriting notes invites freedom and creativity. What if a medium allowed you to write anything to anyone in your past, present or future?

**Speak:** *While physically connected, tell me about or elaborate on a significant encounter with yourself, another or an environment.* Our speaking voice, in its numerous forms, remains a constant tool for communicating with others. How does our vocal medium evolve when it is paired with a physical connection and a sincere listener?

**Think:** *Spend some time in your own head, with your eyes closed, and allow yourself to reflect on an encounter you had today.* Even though a great deal of communication revolves around other people, it begins with ourselves. How might our thoughts develop when self-communication is continually practiced?

For more information on the outcome of this event, refer to the conference poster or a final version of this thesis project.

**IV. Application**

Each medium will serve its own unique and important purpose. Often a thought or idea will be communicated better through one medium over another. We only benefit to expand our options as new forms of communication develop. Edmund Carpenter explains that, “...each [medium] offers a unique presentation of reality, which when new has a freshness and clarity that is extraordinarily powerful.” The latest developments in communication lead to discoveries in expression and interaction.

All methods have proven to be useful in their own right, “Yet a new language is rarely welcomed by the old. The oral tradition distrusted writing, manuscript culture was contemptuous of printing, book culture hated the press...” With any evolution, including our online transition, there is reluctance and distrust towards a new form of communication. By using a ‘middle-of-the-road’ course between all mediums, we find the whole story, says Carpenter.

Preservation of previous communication techniques is just as important as the development of new ones. Communication is at its finest when all mediums are utilized and understood. As new forms evolve, we cannot forget or abandon past techniques. The evolution of communication affects the way we relate to ourselves, others and environments. We cannot afford to communicate without thinking and understanding first. The best execution of communication is when forms generate feelings; if done well and followed by thoughts. When we communicate in new ways, we are changing how we interact, express and live.

Understanding mediums in our daily lives is essential to understanding ourselves, our relationships and the world around us.

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Network Relation Analysis and Connection Visualization Using Graph Theory and Wikipedia

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Abstract - Data visualization is growing in popularity as a tool for effective technical communication. There is inherent merit in organizing and displaying information in creative new ways. This project aims to create an effective connections communication tool. Its purpose is to show how all things are connected. This has been accomplished through an online web application that scans Wikipedia and organizes the topics based on related content. For example, each hypertext (blue) linked article is associated with the article it is in. Through this, a network of related concepts is created. Concept maps (graphs) are then automatically generated showing the relations between articles in a visual fashion. Connecting these concept maps allows users to see the associations between various concepts allowing for further analysis and comparison. Further ease of use and analysis potential is added with the implementation of rating and filter controls for connections. By allowing users to rank connections the functionality of filtering better connections is introduced and can help users tailor their search criteria. This application can function as a brainstorming assistant or a communication tool. There also exists the possibility to expand its functionality and usefulness. Overall it can help people realize the connections between things, and assist with brainstorming and interdisciplinary problem solving in today’s world.

I. Introduction

The world is made of connections. Some are obvious while others are abstract. These connections are why social media works, why professional networking is so important and why the best solutions are often cross discipline collaborations. Concept maps are a way of visually representing the connections between entities. Concept maps are often drawn with the central idea or concept at the center of a page with lines branching out to related ideas. This process continues until you have a web of related content. Often this is an easy way to visualize multiple dependencies or connections between relations. Due to their nature, concept maps are and excellent way of describing relations between multiple objects. Starting with two unrelated objects and creating concept maps for each simultaneously leads to an interrelated mesh of concepts that connects the two. Manually making concept maps can be time consuming, thus an automated web application is great benefit. To this end, this thesis includes an online web application that automatically builds these webs of information. This concept map of connections is useful for a number of reasons: As a brainstorming tool, for visually representing the relations between concepts, checking dependencies and key connections or bottlenecks between objects, and as a tool for explaining ideas and relations. This serves to facilitate brainstorming though the process of random visual stimulation, viewing lists of related content can help individuals make connections and facilitate creative solutions. Another use looks at the growing trend towards info graphics. Pictures speak a thousand words, and often convey more information in a more straightforward manner than words do. By abstracting connections into concept maps you pave the way for people to better understand the relations in the world around them. Such a tool also helps organize information. Similar to how tables and databases store structured information and relations, related concept map meshes store abstract relations and visualizations that would not easily fit
into tables. Depending on the initial dataset this tool might also be able to serve companies and business by helping them track which projects are related to each other. Other aspects of the final paper include implementation details, design process analysis, future implementations and thoughts on philosophical impact and importance.

II. Methods

What first become obvious within this project is the need for an external library or data set of concepts and relations. The most ubiquitous example of such in our world is the online encyclopedia Wikipedia. Wikipedia is a comprehensive dictionary of over 3 million interrelated concepts. It is easy to conceptualize Wikipedia articles as concepts and each hyperlinked or blue highlighted link to another article as a connection between the two objects. Conveniently the idea of concept maps is already well explored in the field of mathematics, expressed there as graph theory. Concept maps are also known as graphs, where each concept or idea is a ‘node’ and each connection or relation is an ‘edge’. There is an extensive range of knowledge on mapping nodes and edges as well as performing graph analysis over a network.

III. Results

My final product works as designed and is currently a web compatible application running on a local machine. The first webpage of the tool prompts the user for two concepts or objects. The program will search the database of articles for similar wordings and phrases and prompts the user for the most appropriate choice. Given two concepts it will build a web of related connections highlighting 5 shortest paths between the two. It uses a scaled down data-set derived from Wikipedia. The original dataset contained over 10 million separate articles and about 300 million relations within those articles. Due to processing limitations and runtime concerns, the dataset in this iteration of the project contains only 2000 articles and 30,000 connections. Each relationship also contains 3 numerical amounts representing their ratings on creativeness, obviousness and abstractness. Users may vote up or down on any one of these ratings contributing to the connections overall score of relevancy.

Regular expressions are used for searching and querying the database. Specifically the first character of a user’s search is stripped and turned into a regular expression with wildcards before and after the word. For example: a search on ‘hair’ return three results, Hair (musical), ‘Japanese military aircraft systems’ and ‘Historical major league baseball over the air television broadcasts’. Breadth first search is used to find the shortest path between concepts. Specifically a first 5 shortest path variation is used. For each use of the tool a unique graph is created.

Graph analysis can sometimes be time-consuming. In this case the scaled down dataset helps to control runtimes. Since the average
distance between Wikipedia articles is 3.5 hops\(^1\) it ensures breadth first search will not usually explore deeper than 3-4 depth. Due to this norm, the program has an average runtime of about 60 seconds for building a graph. Error handling has been implemented to decrease the chances of database corruption. Terms that are not within the dataset will very quickly catch the exception and throw back an error. Certain situations are untested and may result in unpredictable results. Breadth first search at a depth greater than 5 may result in exponentially long runtimes and out of memory errors, no incidents have been encountered yet. The system has a small number of limitations in its current form. If no connection exists between two concepts it is unclear exactly what will happen. Multiple users should not cause collisions since it’s a database implementation, but again this is untested.

Figure 2. First attempt at graphing Wikipedia

IV. Discussion
Throughout this project the tool has grown and changed, and there is the potential for more change to come. A first priority should be enhancing the user interaction. Facilitating user interaction through a cleaner design opens up the possibility for more usage and better testing and debugging through crowd sourcing. Opening the application to World Wide Web allows many of the described and envisioned features to take effect. At this point it truly becomes an idea creation and brainstorming tool. Expanding the dataset is the next step. By expanding functionality it makes it more comprehensive and helps facilitate finding of obscure meaningful connections.

This experience has also been a learning experience, and many lessons from programing intricacies to work habits can be gathered from the design experience. One major observation is that tradeoffs seem to be a large part of effective programing. Usually to enhance one quality or section of a program you have to ‘trade it off’ for decreased functionality in another area. For example shrinking my dataset increases the speed of all my programs, as there is less data to crunch. Here I have traded more comprehensive data for increased speed. Through my work on this project and other computer science experiences this appears to be a reoccurring theme. Effective coding comprises of knowing when to use what strategy. There are appropriate times to use certain languages or techniques depending on your needs and end goals.

While working on a design project it is of tremendous importance to start small and scale up later. Starting small lets you test and improve functionality much quicker than if you had started out big. For example testing my 2000 article dataset takes a couple minutes of real time. Working with the full dataset takes hours if not days for each operation.

This start small approach led to building this system incrementally. That is: building a component, testing it, and then adding another component. This is one approach of creating a software system. It develops the designers understanding of the involved components in step with the system and is a viable way for both students and professionals to build software.

Data visualization is a promising area, it allows for information to be communicated in much more efficient and effective ways. There is much potential for automated programs and applications processing large sets of data to produce unique and creative results.

V. References
The ethics of organ donation: an abuse of patient autonomy, resulting from, family consent in an expressed consent system (Ontario) and a presumed consent system (France).

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Abstract - There are large discrepancies between how organ donation is defined legally and how it is applied in medical establishments. In practice, organ donation can result in a significant abuse of patient autonomy in both presumed consent and expressed consent systems. The biggest threat to patient autonomy is the practice of family consent where families are asked to consent on a potential donor’s behalf regardless of whether or not their wishes are known. I believe that family consent should only be required if the deceased’s wishes are unknown. There is no legal basis for requiring family consent, yet it has become common practice in both Ontario and France. When analyzing the laws concerning how consent must be obtained, it became apparent that relatives, as surrogate decision-makers, do not fulfill the requirements to give consent in either Ontario or France. Studies have also shown that many relatives forgo donation for personal reasons even if the deceased’s wishes were known. Allowing for family consent when the wishes of a patient are known results in an abuse of patient autonomy.

I. Introduction
Organ donation is a procedure where tissues and organs are removed from a living or deceased individual and transplanted into another individual’s body for therapeutic benefit. As a medical procedure, organ donation should hold the same respect for patient rights, both legally and in practice, as other medical procedures do. The hallmarks of patient rights are autonomy and informed consent. Autonomy is defined as the ability to make one’s own decisions (1) whereas informed consent is defined as a patient’s right to be sufficiently informed about medical procedures so they are able to make intelligent decisions based on comprehensive data (2).

Theoretically there are many ways of organizing the consent systems required for obtaining organ and tissue donations. In practice, there are two that are most widely used among developed nations: presumed consent (“opt-out”) and expressed consent (“opt-in”). A presumed consent system, as adopted by France, is one where all individuals within a country are presumed to consent to donating their organs and tissues upon their death unless they have expressed a wish not to. An expressed consent system, as adopted by Ontario, is one where citizens must formally register their consent in order to be organ donors.

II. Methods
Organ donation is a medical procedure and, therefore, should be based on the same principles of consent and autonomous decision making as other medical procedures. I will analyse the legal documents from Ontario and France that outline organ donation and compare how patient autonomy is represented in those documents with how it is meant to be represented based on the legal definition of autonomy and informed consent. Ontario’s organ donation procedures are governed by the Trillium Gift of Life Network Act (3) and patient autonomy is outlined in the Health Care Consent Act (4). France’s organ donation procedures and regulations for consent are governed by the Public Health Code (Code de la santé publique) (5). I will be looking at how each system functions in practice and the discrepancies between how autonomy is defined in their respective legal acts and how it is applied in practice.

III. Overview of legal acts
There are four elements to consent in Ontario according to the Health Care Consent Act: it must be related to treatment, it must be informed, it
must be voluntary and it must not be based on fraud. Consent is not considered voluntary if given by a person under duress. If a person is unable to consent then a surrogate decision-maker is appointed who must fulfill all the elements of consent as the patient would have. The surrogate must make a decision for the incapable person according to any previously known wishes or interests.

France’s consent laws state that for a patient to be informed, a physician must provide clear, honest and suitable information concerning the patient’s condition and the proposed treatment. Consent must be voluntary and informed. If a patient is unable to consent then a surrogate decision-maker (personne de confiance) is appointed who will be consulted with and receive all information regarding the treatment. It is a legal requirement that the surrogate decision-maker be kept informed of all proceedings but they are not able to make medical decisions on a person’s behalf. The surrogate decision-maker’s role is to accompany the patient and to help facilitate communication and understanding between the physician and patient.

According to the Trillium Gift of Life Network Act, any person 16 years of age or older may consent to donating their tissues and organs. Upon a person’s death, their most recent consent is legally binding unless the acting physician has reason to believe that it had been withdrawn. If a person did not give consent before they die, then their next-of-kin can consent on their behalf unless they had reason to believe that the deceased person would have objected.

In France, “Le Registre National des Refus” is a national registry where people can document their objection to organ donation. According to the Code of Public Health, before harvesting organs physicians must consult the national registry, since it is a legally binding agreement to determine if the deceased refused donation. Organs are allowed to be harvested from individuals if the individual did not object to organ or tissue donation during their lifetime. If the physician is not aware of the deceased wishes, then they must contact the family to determine if the individual ever objected to organ donation.

IV. Family Consent

Family consent is the act of a family member consenting on the behalf of a potential donor. Oftentimes, potential donors have not made their wishes known to their relatives and, as such, the burden of deciding whether or not to donate rests with the family. From the perspective of hospitals and physicians, family refusal represents a formidable barrier to achieving higher rates of organ donation. In fact, many potential donors go unused due to the high prevalence of family refusal. In France, family refusal has accounted for greater than 60% of non-used donors (6).

In Ontario, even if a person has registered their consent to donate, their family will be approached with the option of refusing donation regardless of the deceased’s expressed wishes (7). In France, even if the patient has not documented their objection through the registry, then family members are always asked if they would like to donate their relative’s organs (8, 9).

V. Analysis

Ontario has a register where people can document their consent, or objection, to organ donation and, while this register has legal value it is ignored in practice. The practical application of the law abuses patient autonomy by ignoring the decisions made by the potential donor while they were still capable of consenting in favor of the family’s consent.

Furthermore, when comparing Ontario’s Health Care Consent Act with the practical application of the Trillium Gift of Life Network Act, it seems highly unlikely any next-of-kin called upon to consent on a relative’s behalf would meet the criteria necessary to give consent. In Ontario, to meet the requirements for consent, relatives must be informed and give voluntary consent. The challenge for the health care system is that there are substantial burdens in the way of relatives understanding the situation. For example, there is evidence suggesting that the general public does not understand brain death with one study observing that “80% of families who said “no” to donation never understood or accepted brain death” (10). Many refusals arise because relatives do not understand the scientific process behind organ donation and will thus refuse based on unfounded reasons (9). It is also questionable whether a relative would meet the complete requirements for voluntary consent. Relatives are facing an emotionally charged, distressing
situation where a loved one has just died and therefore could be considered to be under duress and incapable of rational thinking.

Even though France’s organ donation law is based around an opposite system of patient autonomy, it’s practical application is very similar to Ontario’s. In France, if a potential donor has registered an objection the family will not be contacted and therefore the registry has applied legal value unlike Ontario’s registry. However, since the French system is one of presumed consent, everyone who has not registered an objection is a donor. In practice, unless the potential donor has registered an objection the family assumes the role of surrogate decision-maker and they are asked to consent on behalf of the potential donor. This means that people who would like to donate and make no effort to make their wishes known due to the assumption that they are presumed to consent are liable to have their decision revocable, or over-ridden, by their family. In this regard, autonomy is abused since once again the deceased’s wishes of the patient are being ignored.

In terms of consent, France states that consent must be voluntary and informed. As found in Ontario, both of these conditions are unlikely to be found in the relatives making decisions on the deceased’s behalf. The only way for an informed decision to be made, which accurately reflects the wishes of the deceased, is for the deceased to make the decision themselves. If the deceased’s consent is already known, then their wishes should be followed regardless of the family’s wishes, because to do otherwise, would be an abuse of a patient’s right to autonomy.

In the emotional situation surrounding organ donation, there is another aspect of the law that is unfilled. In Ontario, the law states that surrogates must make decisions based on what the deceased would have wanted however in some cases even though the relatives were aware that the deceased had wished to be a donor they decided otherwise (12). Oftentimes the relatives decide against donation because they do not want to give up control over the body (11, 13). One study found that the biggest reason for not wanting to donate organs was to protect the body from being cut up because relatives couldn’t stand the idea of their beloved relative not being physically whole (12). These reasons while understandable, have nothing to do with protecting the autonomy of the deceased or protecting their values, instead it has everything to do with the family’s bereavement.

In France, the appointed surrogate decision-maker is not legally allowed to make medical decisions on the individual’s behalf. They are to represent their wishes, and to facilitate communication between the physician and the patient. This means that, for regular medical procedures, the designated surrogate can only represent what they believe the patient would have wanted and the decision for treatment ultimately rests with the physician. This is similar to how the law regarding organ donation works. The law states that, if the wishes of the potential donor are unknown, then a relative or friend will be called upon to state whether or not the deceased ever opposed donation in their lifetime. Since, consent is assumed, the decision to donate will ultimately rest with the doctor if no objection has been found. In practice, however, consent is never assumed and therein lays the abuse of autonomy. Families are asked if they would like to donate the deceased’s organs and not whether they knew if the deceased would have liked to donate their organs. Since France has a system of presumed consent, it is assumed that the best interests of the individual would be to donate their organs and allowing family members to deviate from this choice is, arguably, a violation of the consent laws.

VI. Discussion

Many believe that a physician’s fear of conflict with the family or legal system, combined with the inherent discomfort in harvesting the organs of a deceased individual, leads to the practice of always requiring family consent (9). Indeed, it is the family who deals with the consequences of a relative’s death and they are the ones who “live with the decision” but, if a person has already consented to organ donation, it doesn’t seem legally permissible, according to current medical ethics thinking, to ignore their wishes.

It is a burden on the family to have to decide whether or not to donate a loved one’s organs. There is evidence that family members feel guilt or remorse after their decision (12) and the medical staff who deal with the family often express their discomfort due to the personal nature
of the situation (9).

It seems almost universal that, in practice, the relatives of a deceased individual make the final decision on organ donation. This is an abuse of patient autonomy because the wishes of the deceased are ignored and disrespected. As Den Hartogh says, “if a person has made no will, on his death we dispose of his inheritance in accordance with default rules provided by the law; we would not consider asking his relatives whether he might have preferred to deviate from those rules” (13).

If an individual’s consent has been given and if they have documented this consent in a manner that has legal standing then it stands to reason that their consent should be legally binding. Neither Ontario nor France contain laws that allow for families to make decisions on their relative’s behalf if the relative’s wishes are already known. There is no article defining a family’s right to refuse a relative’s donation and allowing for such a right is an abuse of patient autonomy for the deceased individual. I believe, based on current medical ethics thinking, which stresses patient autonomy, that Ontario and France should both adopt a firmer approach to organ donation where the family’s consent is only required if the wishes of the individual are unknown.

VII. References
The creation of an understandable and accessible web resource to inform consumers about conventional and alternative methods of coffee production

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Abstract - Coffee is an integral part of Western culture, interwoven into morning rituals, social events, and personal habits. Meanwhile, research for this project has shown that it is common for consumers not to know how coffee is produced, nor the standards for, or implications of, various systems of coffee production. The goal of this project is to provide a web-based resource for the average consumer that provides an accessible and understandable overview of coffee production so they may become more informed of what their purchases are supporting. This project is not meant to provide definitive answers of which system is best, but to provide an accessible resource that will describe and review the most common production systems, provide resources for further research, discuss which system(s) is supported by popular retailers, and give suggestions that consumers may choose to follow to improve their impact on those involved in coffee production—all in one place. This resource is found at www.knowyourcoffee.org, which will be accessible online until at least February 2013.

I. Introduction

Coffee has become an important part of everyday life to countless people around the world, as a part of the morning ritual, the afternoon pick-me-up, or after dinner espresso. This project addresses the hypothesis that many consumers know very little about where coffee comes from or how it arrived in their cup. Now that coffee is produced in different ways, sometimes certified through certain programs or others, it is becoming a more complex industry to understand and the casual consumer is often left with an incredible amount of resources on various elements of it, but without a cohesive resource where consumers can easily learn about coffee production. This project is the creation of an online resource to fulfill this need.

This conference proceedings will not discuss the same topics as are discussed in the larger paper or the final project, meaning it will not discuss coffee production systems, standards, or consequences of supporting them. This is because the information gathered for the larger project is not useful to portray in this shortened version and instead this paper discusses the context of the larger project.

As of April 9, 2012, the project can be explored in its entirety online at the website listed below until February 2013, or in a slightly different form in the larger related paper.

Discussed below is the importance of this project, discussion and justification of its goals and form, the methods used to complete it, and briefly the results of the primary research completed.

II. Project Goals

The goal of this project is to provide a resource for the average consumer that provides an accessible and understandable overview of coffee production so they may become more informed of what their coffee purchases are supporting. This project is not meant to provide definitive answers of which system is best, but to provide an accessible resource that will describe and review the most common production systems, provide resources for further research, discuss which system(s) is supported by popular retailers, and give suggestions that consumers may choose to follow to improve their impact on those involved in coffee production—all in one place.
Two important factors informed the way this project was completed: the importance of producing a reasonably comprehensive resource with which consumers may become more knowledgeable; and to do this in such a way that it is accessible and useful for consumers. The importance of creating a resource that is accessible and useful for consumers was informed by Soft Systems Methodology (SSM), which is discussed in depth below, which underlines the importance of finding solutions to complex problems that are reasonable and work within the worldviews of those involved (Checkland and Poulter 191).

III. Final Product

The creation of this project’s end product was also highly influenced by SSM and the importance of a focus on those involved. The final product is a public website, which can be found at www.knowyourcoffee.org. The decision to also produce a website as opposed to just a paper or other product, was intentionally so that the information discovered through this project could be made easily available to consumers. The possibility of creating an exhibit was investigated early on, but was dismissed, as it would have been only a temporary resource for consumers. With the goal of this project being to provide a resource for consumers to become more informed it was decided that a more widely accessible and longer lasting resource such as a website would better serve this purpose. This website will be accessible at www.knowyourcoffee.org until at least February 2013.

In building this website, the importance of the user and using understandable and accessible language was highly emphasized. Before website content was written, it was decided that the intended audience was at least of high school age and education, with a broad age range of 13 to 50 years old, of both sexes. The socioeconomic class of the audience was only considered broadly in that the audience has the means to purchase coffee. The language of the website has been made appropriate for readers aged 13 and up, with a focus on an audience of under 60—the information provided is completely accessible to those over 60, but the language used is intentionally more casual, which may not appeal as much to an older audience.

Keeping with the goal of accessibility for the average consumer, academic-style writing was intentionally avoided in order to make the content more easily understandable and less intimidating or boring. However, some jargon is required in order to discuss the topic, which is often a barrier to accessibility. This was overcome by providing an easily understandable glossary of terms used on the website as well as those often used when discussing this topic elsewhere.

The website was created as a resource for consumers and not as a platform to present this research project. This distinction informed what information would appear on the site as content was written and compiled. As a resource rather than the presentation of a research project, the website does not discuss the content as it might appear in a research paper.

For example, the site does not include any reference to research method, does not have an explicit introduction, literature review or conclusion section. Of course literature reviewed for this project is highly discussed on the site, though it is not described as such. All content is discussed as necessary and as is useful to the audience. Because this is not an academically driven site, as discussed above, these sections were not necessary to include and would have negatively impacted the conversational tone and impact the site is meant to achieve.

The decision to use more casual language was inspired by the engaging feel of having a conversation with a friend.

IV. Methods

In its full expression Soft Systems Methodology (SSM) leads to the production of multiple models that describe a complex process or situation, where each model reflects a specific worldview. These models are then used to ask questions of the “real world situation” in order to spur debate and discussion intended to lead to improvements to the situation that are considered acceptable by all of the considered worldviews (Checkland and Poulter).

The core themes of SSM are used in the research for this project—that is, the importance of understanding who is involved, and the social and political context involved in a problematical situation are considered. The importance of a contextual understanding of a situation informed the very nature of the project and its attempt to provide an overarching summary of coffee production rather than focusing on one element of
it. Of course, a comprehensive summary of global coffee production was beyond the scope of the project, but a useful summary has been completed. The decision to provide a resource for consumers to become more informed was based on the hypothesis that consumers do not often know very much about coffee production or what purchasing coffee produced within certain certifications, or not, really means for those producing it. This hypothesis was confirmed with research completed for this project, though further research, ideally with a quantitative foundation, should be pursued in order to confirm these findings.

The core of SSM informed the decision to complete interviews with consumers in order to understand what they knew about coffee production in general, and about the certification standards and implications. Interviews were also used to discover how consumers interact with coffee in their daily lives in an effort to understand the social context of coffee in the lives of consumers. The interviews were used to understand factors such as how important consumers considered coffee to be in their lives; how much they reported to pay for it; whether they even knew how much their coffee cost; whether they would pay more for it; or even notice an increase in price. All of these questions explored the social context of consumers, which was used to provide a context for suggestions provided on the website for consumers to become more informed, or take action.

V. Results

Interviews conducted for this project revealed many interesting insights and tentatively confirmed the hypothesis that led to this project. It was found that generally consumers are not very well informed about coffee production. This includes knowledge of what kind of plant coffee is produced from, how it is processed to become coffee as consumers know it, and who is involved in producing coffee. All of those interviewed had heard of “alternative” coffee production models generally but most did not know what exactly distinguished one from another. One interviewee revealed that he goes out of his way to buy Fairtrade coffee but was unable to explain what exactly “Fairtrade” meant.

Some interviewees did not know how much they paid for their coffee, suggesting that although some mentioned expense as a deterrent from purchasing alternative coffee models, that a difference in price between coffees may be less important than what they perceive to be more expensive.

VI. Discussion

Coffee consumers should be aware of their purchasing power and of which production systems they are supporting with their coffee purchases. Merely by becoming informed and thinking empathetically about those producing their coffee consumers can become more conscious and able to make decisions that align with their beliefs.

Whether or not retailers supply some or all of their coffee through alternative production models largely determines whether consumers have the option to purchase these coffees. Arguably, if all retailers chose simultaneously to purchase and sell at least some of these alternative coffees, they would remain equally competitive as their current situation and consumers would have to adjust their expectations of price and quality, potentially embracing the “less but better” mindset.

The aim of this project, however, is not to necessarily portray any one production model as the best or worst option. Instead it is meant to be an interesting and accessible resource available to all consumers online, with which they can become informed about how their coffee choices make an impact on those producing it. This website, www.knowyourcoffee.org, will be available from April 9, 2012, through at least February 2013.

VII. References

Game Design Semiotics Framework

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Abstract - Semiotics, or the study of signs and sign processes, can be applied to game design to examine how meaning is made through player engagement and interaction. A Game Design Semiotics framework provides a way to describe the narrative structure, system interactions, and player engagement inherent in a game or game-like system. A semiotics approach focuses on the messages and preferred readings of those messages inherent in the game as a system. Exploring the interactions and interpretations can be the basis for analyzing and comparing a broad class games because of the universal nature of signs, as well as mitigate the lack of universal game terminology. This semiotics approach is consistent with conceptualizations of games as composed of ideal, constructed, and interaction spaces, or viewed in terms of their mechanics, dynamics, and aesthetics. As a tool, GDS can discern functional units of representational, interactive, and compositional elements at a conceptual level, for evaluation, refinement, and reuse. Using such a framework to understand games is useful for the design and iteration of game-like systems, and offers insight on user interface design, user experience, and game design principles.

I. Game Semiotics

Semiotics, or the study of signs and sign processes, can be used to examine games on a number of different levels in order to discern principles of design. Semiotics is concerned with messages and the preferred ways to read them, based on the constituent elements and how they are structured to suggest meaning. The production of meaning in a game and the process of meaning-making by the player can help us to understand the nature of play and how games are ‘played out’ by people.

The fundamental concept in semiotics is the idea of the ‘sign,’ which is triadic in nature, consisting of a signer, a signified and the association between them.¹ There are several differing models of this concept, varying in significance of the alterations. In general the signer is some form that allows for physical perception; the signified is a purely mental concept; and the association is the value or sense of it made in context. These three parts form a whole signifying construct, considered a single unit.

The three main branches of semiotics are semantics, syntactic, and pragmatics. Semantics looks at the relation between signs and their meanings, syntactics looks at relations among signs in formal structures, and pragmatics looks at the relation between signs and the effects on their users. A semiotic analysis of a game can touch on narrative structure, system interactions, and player engagement, to which the three branches roughly correspond to, respectively.

II. Definition of a Game

The vocabulary and definitions for games are not universal. Different terminologies are used, and there are also many definitions of a game that have been offered. Some distinctions outline properties, emphasize particular aspects, describe activities and conditions, or change what classifies as a game or not.

An advantage to using semiotics is that an analysis can be made despite imprecise terms and conflicting notions because it matters only what signs can be found. This in fact is because semiotics transcends any particular domain and so processes or results may be directly applicable or transferrable to other analyses, such as between other games or game-like situations.
For this reason, a broad definition will be adopted, that “a game is a competition for the acquisition of value.” Gaining value is intentionally abstract to include gaining various forms of desirables, such as points, money, resources, artefacts, pieces, kills, positioning, or prestige that is somehow related to contending. Competition, whether human or constructed forces, is about attempting to achieve victory in the presence of some adversarial agent, itself aiming for a victory of its own. Related to the adversarial element is the provision of clear feedback, informing the players of the game and the game state, such as the goal and how close someone is to reaching that goal.

The adversarial element distinguishes a game from other media because the way the designed product is consumed by the player is unpredictable. A desire to understand this unpredictable consumption of a game motivates a semiotic perspective to gain insight into how games ‘play out’ in reality as participants act on the inputs of others.

The application of a semiotic analysis here would help to expose the underlying narrative structures found in the adversarial elements and feedback systems provided in a game.

III. MDA Framework

The mechanics, dynamics, and aesthetics framework (MDA) aims to be a formal abstract tool with which to understand a broad class of games. It is a suitable iterative tool to conceptualize game design for the purposes of development, criticism, and research. The MDA framework is named to describe three major layers of a game, considered as a system. The mechanics are seen as the base level, from which dynamics arise, and the aesthetics are produced in part by the interactions of the other two. Listed below are the definitions of each layer, which highlight relationships of dependency, not hierarchy.

1. **Mechanics** refers to the rules, concepts, and artefacts that formally specify the game-system.
2. **Dynamics** refers to the run-time behaviour of the game-system acting on player inputs and each others’ inputs over time.
3. **Aesthetics** refers to the desirable emotional responses evoked by the game dynamics when a player interacts with the game-system.

The MDA framework is very useful for guiding identification of components as a system and assessing their impact. An understanding of inputs and outputs to game and player interaction contributes directly to the semiotics framework. The flows of interaction will help to examine the system interactions, which encompass the relationships of these flows with the sign systems that motivate them. Of importance is identifying the specific sign processes that produce meaning, that are imparted by the game or by other players.

IV. The Designed Game-World

From a game designer perspective, an understanding of a given ‘game’ is comprised by the game, the rules, and the experience. These three elements can be described as superimposed domains, called the game-space, game-system, and play-space, respectively. The game-space is the designer’s ideal conception, the game-system is what is constructed by the rules and concepts, and the play-space includes the interaction of players in context with the game each other.

The game-space is the ideal essence of the game which has delineated all the possibilities and consequences of the game. In the game-system, these core concepts are specified to generate a presentable form that includes the rules and the artefacts required for play. The play-space is the area generated by player behaviour based on game-system relationships and competitive interaction. Together, the game-space, game-system, and play-space make up the game-world. The extent that these spaces overlap indicates the cohesiveness of the game from designer to consumer. While the experience varies because it is dependent on the human participants, the game concept and construction can be refined to yield the desired experience, but this control is limited.

The play-space explored by players does not always align completely with the designer’s game-space because there are inequalities in context, capacity and creativity. First, the game-system that the players interact with may not adequately represent the game-space whether by omission, inclusion, or loopholes. Rules or structures may improperly deny access to portions of the game-space, or others may allow access to areas outside
the game-space, unintentionally or due to ambiguity. Secondly, players may play the game in unpredictable ways and simply may not explore the game-space as intended, and miss out on significant potential experiences and have a deficient play-space.

A semiotics framework can identify in the game the affordances and constraints that lend themselves toward different forms of player behaviours that energy. The player engagement within the desired game-world, and aberrations of it, are impacted by the messages contained in the game and the ways the preferred readings of them.

V. Game Design Semiotics

A convergence of the semiotic, game-world, and MDA perspectives yields a Game Design Semiotics (GDS) framework for understanding narrative structure, system interactions, and player engagement in games, shown in Table 1. Appropriating the different perspectives allows us to conceptualize a game at different levels, to help guide analysis and frame vocabulary usage.

The GDS framework can mitigate issues with vague terms and differing definitions of games by concentrating on the signs and messages. The narrative structure can be examined in terms of how the adversarial elements and player feedback is provided. The MDA framework offers insight into the sign processes that take place through input and output flows. Meaning-making is an additional layer of information that impacts system interactions. Player engagement can be guided by understanding the preferred ways of interpreting messages and interacting with affordances and constraints of the game-world.

The GDS framework is congruous with approaches from other game perspectives. The notions of narrative structure, system interactions, and player engagement, being based on signs and sign processes can be used to analyze an assortment of games. The emphasis of deriving the messages and discovering the preferred ways to read them can expand the knowledge about how a game works and plays out. Incorporating semiotics can improve game design and game research by expanding meaning and expounding messages.

VI. References


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Table 1. Game Design Semiotics framework as divided by column, showing relationships of game perspectives to (1) Narrative Structure, (2) System Interactions, and (3) Player Engagement.
Exploring the “Wicked Problem” of Underrepresentation: Undergraduate Women in Computer Science

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Abstract - Ever since women courageously demanded access to academia and professional careers outside of their homes, complex social factors have interacted to restrict their choices, education, and career advancement. Although we live in a society that purports to be equal, why is the number of women pursuing undergraduate degrees in computer science so low compared to their male peers? In an attempt to untangle the major social forces that cause women's underrepresentation in computer science education, it was found that this problem is actually a type of complex, challenging design problem first defined by Rittel as a “wicked problem.” A preliminary case study of the status of women at the University of Waterloo's David R. Cheriton School of Computer Science was conducted with the insight and collaboration of students and faculty members in this program. An approach incorporating interdisciplinary and design practices and which includes philosophers of science, and other non-computer science scholars, is suggested and explored.

In design, research questions are asked in order to address specific needs that are identified by stakeholders. A research question is called a “problem” or “problem definition,” and identifies the exact criteria that must be met in order to address stakeholder needs, and be considered a successful “solution.” The solution is a designed product or system that responds directly to the problem definition.

The original intention of this project was to address the underrepresentation of women in computer science (CS) at the undergraduate level by defining the problem, which means identifying the main, relevant causes of the problem, and developing solutions to it. This could only happen in collaboration with students, faculty, and staff from the University of Waterloo’s own school of computer science. However, these goals turned out to be impossible, at least in the current context and with the current state of knowledge of the researcher. It was found that the underrepresentation of women is a “wicked problem.”

In the 1960s, Horst Rittel introduced a concept which is now integral to the discipline of design, the concept of the “wicked problem” (1). He and subsequent scholars defined wicked problems with several characteristics, including that they are complex social problems, “very difficult to formulate,” involve “many clients and decision makers with conflicting values,” and have no logical end nor “right or wrong solutions” (2,3,4).

The underrepresentation of women in computer science is such a wicked problem. The situation is clearly a complex social problem, considering that currently, women in the United States only earn 20% of the computer science bachelor degrees that are awarded every year (5). As of September 2011, the University of Waterloo (UW) full-time undergraduate computer science program is only 11.6% female students (6). Countless social factors, at the individual, familial, community, institutional, and societal level contribute to the extremely low numbers of women that can currently be seen, both enrolled in and graduating from computer science undergraduate programs. Identifying all of these factors and how they interact, which is required to formulate the problem, is “very difficult.”

Also, there are countless groups with
stakeholders in this issue. Computer scientists and women students who are interested in entering this field are obviously at the heart of this issue. However, university administration and faculty, industry leaders, high school and middle school teachers and guidance counsellors, parents, and the media all play a part in this problem. Each of these stakeholder groups have different needs, perspectives, and viewpoints about the causes and appropriate, successful solutions.

I would argue that there is another very important group that is often not considered, which is the communities of scholars whose research programs relate to this topic. These scholars, such as feminist scholars, philosophers of science, social psychologists, as well as scientists who conduct research into sex differences in cognition, are all key players because their work has the potential to contribute significant insight. As a result, these non-CS scholars can help identify, clarify and offer solutions to the various aspects of the underrepresentation of women in CS.

Thus, we can see that the underrepresentation of women in computer science is a complex social problem which is difficult to formulate, and involves many diverse groups. It is a clear example of a wicked design problem, implying that there are no logical solutions, none that are right or wrong.

In the face of a wicked problem, Boradkar argues that, “the only way to devise comprehensive solutions that meet the needs of a large and diverse group of stakeholders is through an intense and integrated collaboration among disciplines” (7). When this was realized, the project became oriented towards creating a foundation for this type of interdisciplinary collaboration to occur, specifically at the University of Waterloo.

In total, this project is comprised of four main parts: a summary of literature on the various factors posited as causes of women’s underrepresentation in computer science; a presentation and report communicating the findings of the project and the relevance of cross-disciplinary dialogue, to be shared with project collaborators in computer science at UW; a paper examining the findings of this collaborative project and proposing an approach to solution development that integrates the practices of interdisciplinary research, design, and socially-relevant philosophy of science; and lastly, a presentation aimed at a general audience, which summarizes project recommendations and provides critical thinking tools to evaluate and critique commonly-held myths about women in computer science.

These pieces serve to report on the work of this project and communicate these findings to a diverse set of audiences, who have different interests and stakes in the problem. Also, and most importantly, they collectively set the foundations for a future interdisciplinary collaboration between computer scientists who are working on the underrepresentation of women and other scholars who have been examining this issue from a different perspective.

Boradkar argues that interdisciplinary collaborations “can tame some of the wickedness of design problems,” as it is only through working with other perspectives that we have “the possibility of more comprehensive solutions” (8,9). Thus the desire to understand complexity when designing for real-world problems drives the need for interdisciplinary collaboration for the computer scientists, teachers, university administrators, industry leaders, and students who are working to make the CS climate more inclusive for women. These stakeholders are striving to solve a complex problem, which can only be understood when many perspectives are integrated. In this way, “problem solving in the real world is an important driver for integrative and collaborative research” (10).

While computer scientists on their own have produced a fairly comprehensive body of literature on the problem, the CS community stands to gain significant insight from engaging with scholars outside their discipline. Philosophers of science and feminist scholars, for example, have developed many relevant theories and critiques based on research about women’s underrepresentation in male-dominated fields, such as computer science. These theories offer powerful frameworks for
understanding the complexities of gender biases, in both their explicit and implicit forms, and across many social levels. Computer scientists could use these highly-developed bodies of knowledge to organize the experiences and perspectives they encounter in their everyday interactions, and utilize the insights gained to develop more comprehensive and fine-tuned solutions in their disciplinary institutions.

On the other hand, this type of collaboration would be very beneficial to the non-CS academics who could contribute. As Krohn argues, “the problem-solving power of disciplines is strong only with respect to theoretically simplified versions of problems” (11). If academics wish to know about complex instances of an academic theory in the real-world, he states, “interdisciplinarity is needed” (12).

Thus, philosophers of science and other non-CS scholars would benefit from interdisciplinary collaboration by incorporating real-world complexity into their theories by “link[ing] abstract ideas and case-specific knowledge,” a “fundamental requirement” of interdisciplinary knowledge production, according to Pohl and Hadorn (13).

Some scholars may think of this type of work as “applied”, and therefore consider it of little use to developing the theoretical core of their discipline. However, by applying their theories to relevant, real-world situations or case studies, philosophers of science and feminist scholars can test their theories. Collaborating with computer scientists would offer these academics an invaluable opportunity to put their work into practice, test it, and revise their theories, making their work stronger and more valuable to their discipline.

The results of this research project demonstrate that the underrepresentation of women in computer science programs at the undergraduate level is a wicked design problem; it is a complex social problem in which it is challenging to pinpoint root causes, involves many diverse stakeholders and decision-makers, and therefore does not have a logical end or solution. One approach to dealing with this complexity, or wickedness, is to engage in interdisciplinary collaborations. In this particular situation, such a collaboration would include computer scientists, students, philosophers of science, feminist scholars, and any other scientists or academics whose work relates to the various aspects of the problem.

Interdisciplinary research practices, design practices, and even socially-relevant philosophy of science practices can be integrated to create an approach that is tailored to the complexities of this particular problem. It is through such an interdisciplinary collaboration, beginning with communication and relationship-building between groups, that we can hope to address the underrepresentation of women in computer science education.

References
Analogical processing can evoke emotion while reading fiction

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Abstract - A large part of why we love fiction comes from the emotional experience of reading, and there are many techniques that writers use to give this effect, such as analogy. Research in analogical processing suggests certain types of analogies can evoke emotion (2). With the help of current cognitive research, I conducted a case study and analysis of my own reactions to analogy in fiction. I expected to see emotional responses from analogy, particularly those involving aspects external from the text at hand. My research shows analogy as an effective way for writers to evoke emotion in fictional works, similar to the ways that current cognitive theories suggest. This case study does not offer analogy as the sole literary technique to evoke emotion – there are undoubtedly many more to explore. However, it does provide a cognitive view of analogy in literature, and illustrates the potential this perspective could have for further research in understanding the effects of analogy and why we read fiction.

I. Introduction

Reading can provide powerful experiences. In sonnet 45 of his Astrophil and Stella sequence (1), Sir Philip Sidney describes the emotional effects fiction can evoke:

Stella oft sees the very face of woe
Painted in my beclouded stormy face:
But cannot skill to pity my disgrace,
Not though thereof the cause herself she know:
Yet hearing late a fable,
which did show
Of lovers never known, a grievous case,
Pity thereof gate in her breast such a place
That from that sea derived tears’ spring did flow.

The speaker of Sidney’s poem asks a valuable question. How is Stella not moved by a situation that involves her, yet brought to tears by a fictional tale? She seems unable to have the same connection to reality that she does with fiction.

Perhaps Stella’s reaction shows one reason why people read (and love) fiction: it can evoke intense emotion. If this is the case, how and why does this happen? How do words, mere markings on a page, create a genuine emotional response?

To answer this question, it is helpful to look at the techniques used in creating literature, and the relationship a reader can have with them. One such technique is analogy, and with our current understanding of analogical processing it is possible to at least piece some evidence together about fiction evoking emotion. On top of the analogies an author places in a text, concepts, events and emotions that characters engage in can be compared to the reader’s thoughts, experiences and emotion. All of this requires the reader’s abilities in analogical processing.

Connections have been made between analogical processing and emotion (2). Further research in this area could generate answers to the strong connection we can achieve with the fiction we read.

The creation of an analogy involves the application of an unfamiliar concept (the target domain) to a better-understood concept (the source domain). This process is called mapping. When we map a target onto a suitable source we can “use the resulting correspondences to guide construction of a schema that embraces both [domains]” (3). We learn from analogies by creating a schema that takes elements of both domains into account.

Thagard and Shelley (2), group emotional analogies into three types: those about emotion, those that transfer emotion and those that generate emotion. In analogies about emotion, the target domain is an emotional state, and the mapping is used to explain this emotion’s nature. Analogies that transfer emotions include those that try to evoke empathy by taking one person’s unfamiliar situation and mapping it onto an experienced situation to better understand the emotions involved. Finally, analogies that generate emotions include those that wish to create humour, irony, discovery or
motivation. It is possible that all types of emotional analogies are present in literary fiction, and serve the important purpose of evoking emotion.

II. Methods

Based on my knowledge of literature and its use of analogy, I organized analogies into three categories to study my own use of analogical processing while reading. These categories include internal, external and personal analogies. I expected each category to have a different effect on the reader, and hypothesized that certain categories would produce larger emotional effects than others.

Internal analogies involve mapping two domains that are held within the text at hand. For example, within a novel, a writer might create two analogous events to emphasize a particular thought. This can be seen in Timothy Findley’s novel The Wars (4), where three characters pronounce horrific events in the war to be “marvelous.” This occurs at three very separate places within the novel, and three very different characters say it. However, when compared, they emphasize the confusion and contradiction seen in war.

The author of a text also creates external analogies. These are mappings between a domain contained within the text at hand, and a domain that is external to it. External analogies are particularly present in historical fiction and allegory, as seen in texts like Animal Farm (5) that map a fictional story onto a historical event. Authors can also create external analogies with other literary texts. This type of external analogy is shown in Margaret Atwood’s The Blind Assassin (6), where the narrator compares aspects of Coleridge’s poem Kubla Khan (7) to her life.

Authors of a text always create the mapping between domains in internal and external analogies. However, in personal analogies, it is the reader that creates the mapping. In these cases, he reader maps a personal experience to an event or concept within the text at hand. The nature of this personal experience can vary greatly. A personal analogy could involve an individual’s thoughts, understandings, reading or personal experiences. This heavy reliance on the reader’s participation suggests that personal analogies will likely be unique from reader to reader. This makes them extremely subjective and possibly intimate. Because of their unique nature, I expected personal analogies might evoke more intense emotion.

I analyzed these three types of analogy by creating a case study of my own reading experience. While reading four fictional texts I recorded and analyzed the analogies I found and created, organizing them into the three categories listed above. I also recorded any strong emotions and memories I experienced while reading, to be sure I would not miss any analogical processing that I participated in. After reading these texts, I analyzed my records and the passages that they corresponded with to see if there were consistencies between analogy and emotional reaction. All analogies that evoked emotion were organized according to Thagard and Shelley’s (2) emotional analogy categories. When analogies did not fit into these categories I created new categories to describe them.

By recording, analyzing and categorizing the analogies found in my reading experience, I hope to provide support for, and give insight for the limitations of, the relationship between analogy, emotion and fiction.

III. Reading Margaret Atwood’s Blind Assassin

Margaret Atwood’s novel The Blind Assassin (6) is the most complex work I read, in terms of analogy. Throughout the novel Atwood creates internal and external analogies, and then expands them later by forming new domains. This creates large, multi-domain analogies that combine the three categories I studied.

The largest example of an expanded analogy begins with a quotation from Coleridge’s Kubla Khan, and an emphasis on the terrifying nature of the pleasure-dome (a walled-in space created for Kubla Khan, who becomes frightening because he has “drunk the milk of Paradise” (7). Atwood initially creates a small analogy between the pleasure-dome and her main character’s life, which is described as having “walls and towers girdled round, so nobody else could get in” (6) At first, this seems like a simple two-domain analogy, but later in the book it is expanded. Two more domains are added by Atwood, one involving a science fiction story about a far off, Paradise-like planet, and another involving a specific description of happiness, describing it as “a garden walled with glass” (6). In all, the analogy involves three internal and one external domain, created by Atwood.

However, as this analogy panned out, I found myself creating more domains for it. Because I added these domains on my own, they fall under personal analogy. Both of the personal domains come from my reading experience.

The pleasure-dome analogy ended up extending (for me) into six domains. They combine internal,
external and personal analogy to, essentially, make a mess. It is impossible to map all six domains at once, and comparing different combinations of the domains brings out different schemas.

Most importantly, though, is the fact that with these complex comparisons I also found complex emotion. The emotion I had to an analogy expanded and changed with each additional of a new domain. Emotion worked similarly to schema formation, with different emotions being evoked depending on what domains were compared. Again, evoking emotion by mapping all six domains at once is far too messy for a concise emotional response.

Although my study of analogy and emotion turned out to be much messier and complicated than expected, I was able to expand Thagard and Shelley’s (2) emotional analogy categories. Wimith The Blind Assassin, I found mappings that worked in a similar way to analogies about emotion, but did not directly talk about an emotion. I consider them to be analogies with emotional baggage. Instead using an emotion as the target domain, analogies with emotional baggage use a situation or concept that is known to involve emotion. For example, when Atwood creates a domain with Kubla Khan’s pleasure-dome it is necessary to understand that happiness and pleasure are involved, but these emotions are not directly referred to. Like analogies about emotion, analogies with emotional baggage tend to be explanatory and emotion is always a central part of this explanation. Along with this explanation, some sort of emotion tended to be evoked.

IV. Discussion

The case study I’ve performed on myself does not give a full account of why we read fiction or why we are able to have strong emotional connections to it. However, it does give a new perspective on the way analogies function in literature and make use of the reader’s cognitive abilities.

The categories that I used to organize analogies (internal, external and personal) provided means to describe the nature of analogy in literature, but were unsuccessful in organizing emotional response. Analogies from different categories were able to work together, making their distinctions in emotional response difficult to identify. Because of this, one type cannot be said to elicit stronger emotions than the others.

Internal and external analogies were much more prevalent than personal analogies. This might explain why analogies that produce empathy weren’t very common in my reading – they require personal experience and therefore personal analogy to function.

Despite this subjectivity, analogy does seem to have the ability to evoke emotion in fiction, and this could be one reason why fiction is so popular. In my personal observations, the analogies that evoke emotion can be related to Thagard and Shelley’s (2) descriptions of emotional analogy. What’s more, the analogies that evoked the largest emotional response tended to refer to an emotional state (ie. they were analogies about emotion or analogies with emotional baggage).

Even more interesting, some of the most emotional and memorable passages in a work involved analogy. I found that the passages I had loved and remembered from past readings involved analogies I hadn’t noticed prior to studying them within this context. Although this is an exciting possibility for the role of analogy, it is likely that this observation would not hold true in all readers. Being an English Literature student, I have been taught to take a formal approach with literature, and this includes paying close attention to literary techniques such as analogy and metaphor. Because I invest more time in understanding and noticing these techniques, they may elicit stronger emotions in me than they would in a reader who is not familiar with them. More research with a larger variety in readers and texts would help to shed more light on this subject.

If my case study shows anything, it is a new perspective on how to study cognition while reading. Many researchers have taken a very scientific approach to their questions about cognition and the effects of reading. However, as my observations show, focusing on literary techniques can also bring answers. The study of analogy and metaphor is only one of these techniques, and this approach can be expanded to include many more.

V. References

Investigating the use of ePortfolios in the Knowledge Integration undergraduate program

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Abstract - Knowledge Integration is a new degree at the University of Waterloo, and the first of its kind anywhere. The program faces many of the same challenges any new degree would: creating a sense of community, having new instructors, and building a name on campus, in the community, and beyond. It also face challenges as a unique program, including describing the degree to others and showcasing student work. With the first cohort about to graduate, there is an opportunity to review the program. Three useful areas of review of the Knowledge Integration undergraduate degree have been identified for further research: communication amongst students and between students and teaching instructors, integration of courses and learning objectives over the degree, and portfolio capabilities for students in the program.

This project will investigate specific ways to use ePortfolio technology to improve communication, integration, and portfolio capabilities in the Knowledge Integration program. The use of ePortfolios serves multiple purposes including learning, assessment and employment (1). The University of Waterloo is piloting a new Learning Management System provided by Desire2Learn with an integrated ePortfolio feature that enables students to keep a digital archive of information throughout their degree (2).

I. Introduction

The Bachelor of Knowledge Integration degree at the University of Waterloo is a new program focused on making connections across disciplines (3). With the graduation of the inaugural cohort, an excellent opportunity arises to reflect and to review the program. Through a review of the learning objectives of the program, and an analysis of how successful the program design is in fulfilling them, a set of recommendations for improving the program design will be presented. This project will then look at how improvements could be implemented with ePortfolios, using the strengths of this technology to supplement the current strategies for fulfilling learning objectives.

The program review will focus on three specific areas, including communication, integration, and portfolios. Communication includes social interaction amongst students and between students and instructors. Integration examines how well the course material from each year relates to one another in their attempt to fulfill learning objectives. Portfolio capabilities stem from the importance of sharing work, and the processes behind it, with members of various communities (4).

Members of each cohort were asked to fill out a survey reviewing their experience in each of these three areas. Approximately 40% of the students currently enrolled in Knowledge Integration responded to the survey, and the results reveal several opportunities for improvement. After reviewing the results, recommendations regarding all three topics, and how ePortfolios can aid in the implementation of these recommendations, have been created. The goal of this project, through presenting these findings to the Centre for Knowledge Integration and ePortfolio designers, is to effectively implement ePortfolios into the program to influence the current design of learning objectives.

II. Methods

The design of this project began with research on the use of ePortfolios in integrative programs. Out of this research came three areas for further research. A survey was designed with questions relating to communication, integration, and portfolios. The communication section included questions on a student’s connection to the community and instructors. It also looked at how important these connections are and how satisfied students are with their interactions.

Questions relating to integration over the four years looked at how components of each course fit into the degree. These questions looked at the
perceived usefulness of these components and how well the overall course prepared students for future terms. Portfolio questions focused on how students currently capture reviews and reflections, coursework, and other resources. Furthermore, students were asked how they share these articles with others and the importance of being able to share them.

Both quantitative and qualitative data was collected. Quantitative data was collected because it is very useful in comparing students in each of the four cohorts with each other. Qualitative data is important to ensure the students’ understanding of the questions and the reasoning behind their answers is consistent with other students'. All students currently enrolled in the INTEG 10 group on the university’s learning management system received an email request to respond to the survey within a two week period.

III. Results

Students were asked to respond to a predetermined set of questions based on which cohort they identify with. Of the 84 members of the Knowledge Integration program, 34 responded to the survey, including 8 students who identified as being in first year, 10 in second year, 8 in third year, and 8 in fourth year. Answers were then translated into numbers (“no”=1, “yes”=2, and “not at all”=1, "somewhat”=2, “mostly”=3, “completely”=4) and analyzed.

Results for questions that were asked of all or most cohorts were compared to identify trends, in each of the three areas, over the four year degree. Specific data that only related to individual cohorts will be used to guide recommendations for the final report.

The trends show that the importance of community is consistent across the four years, and is relatively high (3.35±0.20, P=0.05). The perceived level of connection to the community for a student in each year (2.65±0.25 P=0.05) and the satisfaction of the number of interactions (2.76±0.17, P=0.05) are both lower than the importance of this connection.

On average, seminar attendance is higher in first year (3.13±0.44, P=0.05) and second year (3.10±0.62, P=0.05), when compared to third (2.38±0.82, P=0.05) and fourth year (2.38±0.90, P=0.05). In contrast, Knowledge Integration Student Society’s event attendance in first year (2.00±0.37, P=0.05) goes up on average in fourth year (2.63±0.82, P=0.05), as do interactions outside of these events (from 1.38±0.36 in first year to 2.5±0.64 in fourth year, P=0.05).

Fig 1. The importance of community is, on average, higher across the four cohorts than both a student's connection to the community and how satisfied a student is with the number of opportunities to interact.

Fig 2. Seminar attendance declines in the upper cohorts. However, from first to fourth year both attendance at Knowledge Integration Student Society events and other social interactions goes up on average.

Fig 3. The perceived amount of preparation core courses offer a student for future courses is lower on average during the Museum Course than in both first and second year.
A student in first year (3.00±0.52, P=0.05) or second year (3.11±0.48) is more likely than a student in third year (1.71±0.34, P=0.05) to understand how their core courses prepare them for the rest of their degree. Updating individual learning plans is, on average, more prevalent in fourth year (1.63±0.36, P=0.05), compared to first year (1.38±0.36). All questions were also checked for strong correlations between answers. There were no strong correlations found across all four years.

IV. Discussion

It is difficult to have strong trends in any data, considering the limited population of students who are active members of the Knowledge Integration program. Still, some patterns emerged in the data that warrant discussion and further investigation.

There were a few interesting results relating to communication within the Knowledge Integration community. The importance of community is expected to be similar to the level of a student’s connection to the community. The fact that a student’s perceived connection was much lower than the importance of that connection implies that students understand the importance of community, but that there is room to improve how connected they are to it.

We know social interactions and a sense of community are an important part of education (5, 6), and, since students are not satisfied with the number of interactions, ePortfolios can provide an alternative way to interact with the Knowledge Integration community.

Seminar is only one way to engage students within the community. The data suggests that students in upper years are not attending seminars, but are finding social interactions in other places. This is an important finding because, if the effectiveness of seminar relies on students from all years of the program attending (6), the Centre for Knowledge Integration will have to find motivation for upper year students to attend, beyond social interactions.

In terms of integration, there were few questions that compared all four years directly. Responses to one particular question suggest that students going through the Museum Course are less likely to understand how their core courses prepare them for future courses, when compared to first and second year students. If consistent levels of integration are important to the program, further research is needed to understand why third year courses are not perceived as being helpful in preparing for the 4th-year independent thesis. The use of ePortfolios to track the accomplishments of specific learning objectives, over the four years, would help students understand how each course prepares them for future studies (7).

In terms of portfolio capabilities, the results of the survey reveal one recurring trend: insight into what upper years consider important, can help first year students be more successful. On average, upper year students update their learning plan term-by-term. Conversely, first year students do not expect to update their learning plan PERT charts as often. Critical reflection is an important skill (8), and having upper year students share these reflections can help first year students understand the significance of various assignments. This is the most important potential use for ePortfolios in the Knowledge Integration curriculum.

The results suggest several areas for improvement in terms of communication, integration, and portfolios. This project will continue to recommend improvements to the Centre for Knowledge Integration. These recommendations will be consistent with research on the effectiveness and limitations of ePortfolios and the findings discussed here. They will influence the strategic plan for the future of the Knowledge Integration program, and aim to be effective over the long-term.

V. References