Canadian Citizens' Acceptance of Voting Technologies

by

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Abstract

Voting technologies are becoming more pervasive around the world in a bid to increase convenience, accessibility, boost voter turnout, minimize human error and reduce time before results are available. While some countries have instituted or completed trials of different methods of electronic voting, Canada has kept use of voting technologies to limited municipal and provincial elections. This study included an online questionnaire and interviews to gain a better understanding of Canadians' perspectives on voting technologies. From the results, we see that security concerns are the major factor driving this reluctance, but, Canadians have a need and a desire for more convenience and accessibility in their voting. While voters are concerned about security, they trust their government to ensure secure voting methods.

Keywords: voting technology, online voting, acceptability of technology, technology acceptance model,

Focus: determining factors required in acceptability of voting technologies amongst Canadians for use in governmental elections.

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Chapter 1: Introduction

1.1 Motivation

My selection of a thesis topic related to the use of voting technologies stems from my interest in the cross-section of government and politics with technology, and how technology influences our interactions with democracy.

2018 was the first year in which an election I voted in, both the Ottawa municipal election, and the Ontario provincial election, incorporated technology into the voting process. While some municipalities and electoral districts had previously adopted online voting or other assistive technologies, this was my first encounter with the technology. Both my polling stations for the municipal and provincial elections included electronic poll books and ballot counters. The decision behind the adoption of the technologies was to make the process of voting faster and with fewer errors. This would allow voters to get in, vote, and get out of their polling station with relative ease, and then once the polling stations closed at the end of the night, results would come in much faster.

For the most part, this is what happened. But, the online voting systems employed across the province did not fare as well. 51 of the municipalities whose online voting system was provided by Dominion Voting Systems experienced outages which required an extension of voting hours, with 11 communities extending voting into the next day. The 99 Ontario municipalities which used online voting organized by Intelivote Systems did not experience any issues (Gollom, 2018). Despite the computer problems, the number of municipalities adopting online voting for their elections is only continuing to grow. From 12 municipalities in 2003, to 44 by 2010, 97 in 2014, and finally 194 in 2018. One of the major factors cited for the adoption of online voting has been accessibility. As Canada's population ages, it can make it more difficult for citizens to drive to their local polling station, stand in line for upwards of an hour, and mark a ballot with a tiny pencil.

This consideration for accessibility was particularly striking when I worked as a Deputy Returning Officer (DRO) in the 2019 Alberta general election. While the province had elected to use electronic poll books and vote tabulators for the advanced polls, they opted out of their use on election day itself. This means that all votes cast on election day were tracked and cast solely through the use of pencil and paper. This method is effective for young and able-bodied voters,

and while inconvenient, it is still effective for non-English-speaking voters. This method does not, unfortunately, allow individuals with disabilities to vote with the same autonomy as other voters. The province of Alberta supplied a large pencil (for those with difficulties with dexterity), a magnifying sheet (for the vision-impaired), a ballot template (for the blind), and if none of these aids are found to be effective, a voter can have someone swear an oath and help them vote behind the screen.

As I escorted a blind individual and their seeing-eye dog behind the screen, I read aloud the candidates while the voter followed along, counting each of the holes in the template. The voter then took my arm as I led them back to the table to place their ballot in the box, and back across the polling station to the exit. While this amounted to a total of 10 minutes of this voter's day, there was no way for this voter to cast their ballot autonomously and secretly like the seeing voters. This experience angered me and inspired me to consider the adoption of voting technologies and the necessity of accessible methods of voting.

Although my motivation was solidified with this experience with accessibility, my focus in my research related to a broader range of issues relating to the acceptability of new voting technologies, with accessibility being an aspect, rather than the focus.

1.2 Brief Overview of Related Work

The majority of research on Canada's use of voting technologies has been conducted by Nicole Goodman, Assistant Professor at Brock University and Director of the Centre for e-Democracy. Much of Goodman's research focuses on the use of online voting to increase voter turnout in municipalities and First Nations Communities across Canada. From Goodman's work, it is clear that introducing voting technologies does not necessarily have a significant effect on voter turnout, especially when the alternative methods of voting put an increased temporal burden on the voter, such as through pre-registration for online voting. But the introduction can still be found to increase turnout when the municipality previously only offered paper voting. Much of the focus of her work is on the social aspects of voting: increasing turnout, perceptions of citizenship, digital disenfranchisement of voters, and the overall social effect of online voting on voters.

Other work being done in this field is by Sang Ok Choi and Byung Cho Kim of Virginia Tech and Korea University, respectively. Their study, Voter Intention to Use E-Voting

Technologies, leaned heavily on the Technology Acceptance Model while highlighting the importance of security in e-voting technologies. Choi and Kim also factored in the type of political election (presidential, gubernatorial, and local mayoral elections) as well as the voters' political ideologies to see what other factors may influence a voter's willingness to accept voting technologies. Their findings suggest that voters do not consider confidentiality to be a determinant of the usefulness an electronic voting system, but it is still considered to be a factor required for the adoption of an electronic voting technology. As well, they found that of elections at all levels of government, voters trust electronic voting the least in their local mayoral elections due to the higher possibility of their vote being traced back to them individually.

1.3 Research Questions

Right now, the dialogue around voting technologies focuses on accessibility, the desire to increase voter turnout, security concerns, and fear of election interference. The juxtaposition of the positive and negative talking points drove the consideration of three research questions:

RQ1: What concerns and attitudes do Canadians have about voting technologies?

RQ2: What factors drive Canadians to accept a voting technology?

RQ3: What are Canadians' major barriers to acceptance for voting technologies?

With these questions, I aimed to gain a better understanding of Canadians' perspectives on these new technologies and what governments of all levels must do to encourage the adoption of these new technologies.

1.4 Statement of Contribution

The main contribution of this research is to ascertain the factors required by a voting technology in order for it to be accepted and adopted by Canadians. While there are theoretical models outlining the factors required for the acceptance of general pieces of technology or software programs (General Technology Acceptance Model), voting technology has a higher emphasis on security and confidentiality as it effects the governing of municipalities, provinces, and entire democratic nations. In addition to the factors which must be met by a voting technology, the study aims to identify the specific attitudes Canadians hold towards voting

technologies and the factors which either help or hinder the acceptance of the technology by Canadian voters. In this study, I:

- Created a proposed model for the factors required in a voting technology to be accepted by citizens
- Conducted an interview study based on the model, and applied qualitative analysis
- Conducted a questionnaire study based on the model, and applied quantitative analysis

1.5 Thesis Organization

- Chapter 2 will overview the legal context of voting technologies in Canada according to the Canada Elections Act, followed by an examination of attempts at instituting various methods of alternative voting around the world and in Canada. This context allows for greater understanding of how democratic institutions at home and abroad are addressing the increased demand for technology in elections while mitigating for the security risks inherent in large-scale technological adoption.
- Chapter 3 will include the introduction to the theoretical model I have constructed to assess the acceptance and adoption of voting technologies in Canada as well as the models it builds off.
- Chapter 4 will consist of the methods used to conduct this study.
- Chapter 5 will present the analysis of the quantitative results of the survey study conducted online as well as the analysis of the qualitative results of the interview study conducted in-person.
- Chapter 6 will contain the discussion of the results.
- Chapter 7 will contain the conclusion, after which will be the list of references, appendices, and the ethics application.

Chapter 2: Alternative Voting Around the World

2.2 Voting Technologies

Accessible voting acts as a great equalizer. All citizens, no matter their location, profession, or physical ability, should have the ability to vote with anonymity and autonomy. voting technologies is a term which incorporates a number of different technologies involved in different steps of the voting process. Most basically, a voting technology is the "means of both casting and counting votes electronically, involving the transmission of ballots and votes via telephones, private computer networks, or the internet" (Essensa, Alternative Voting Technologies Report, 2013). This can include accessible voting devices used by persons with disabilities, optical scan voting systems, touch screen voting machines, telephone network voting, or online voting. As there are a number of definitions for what constitutes a voting technology, the term will be used in this thesis to denote electronic technologies, including the internet, used in the process of marking and/or submitting a ballot.

In Canada, voting processes must meet several criteria in order to be accepted. Voting processes must be democratic, accurate, secure, secret, auditable, confidential, transparent, accessible, neutral, and simple (KPMG/Sussex Circle, 1998). No voting technology would be accepted in Canada without meeting these criteria.

Technology is often introduced as a way to increase voter participation and turnout, but is found to be most effective at increasing turnout when coupled with adequate voter outreach and education (Delvinia, 2004). Education and outreach are required because voters can be highly resistant to changes in the technology used to cast their ballots; they prefer methods with which they are already familiar. When voters are exposed to fraud and security considerations, they maintain their affinity for paper-based methods of voting, but when primed with convenience considerations, this changes and causes them to show higher preference for e-voting solutions (Alvarez, Levin, & Li, 2018). E-voting refers to electronic voting conducted over the internet or through a network connection. This could be an online voting website or voting machines connected to an internal network to enable faster tabulation. While opinions of voters can be swayed about the place of technology in voting, voters will build trust with the new technologies when given the chance to use them, and when they are given the chance to gauge the usefulness for themselves (Choi & Kim, 2012), (Alvarez, Levin, & Li, 2018).

Technology is not being introduced into the Canadian electoral systems simply as a means of addressing low voter turnout. The main problem with paper ballot voting is voters' mistakes (Kahani, 2006). The bubble-ballot design (fig. 1) used in Canada discourages many forms of errors as it does not require the voter to write any candidates' names, but it still leads to errors when voters may struggle to place an X in the bubble next to the candidate of their choice. Another concern with the manual voting system is that the security of a paper-based manual vote with a manual count is extremely low. This is because there are only single copies of each vote, very little to no redundancy of data, and a very weak audit trail. This makes votes easy to tamper with or destroy (Mugica, 2015).

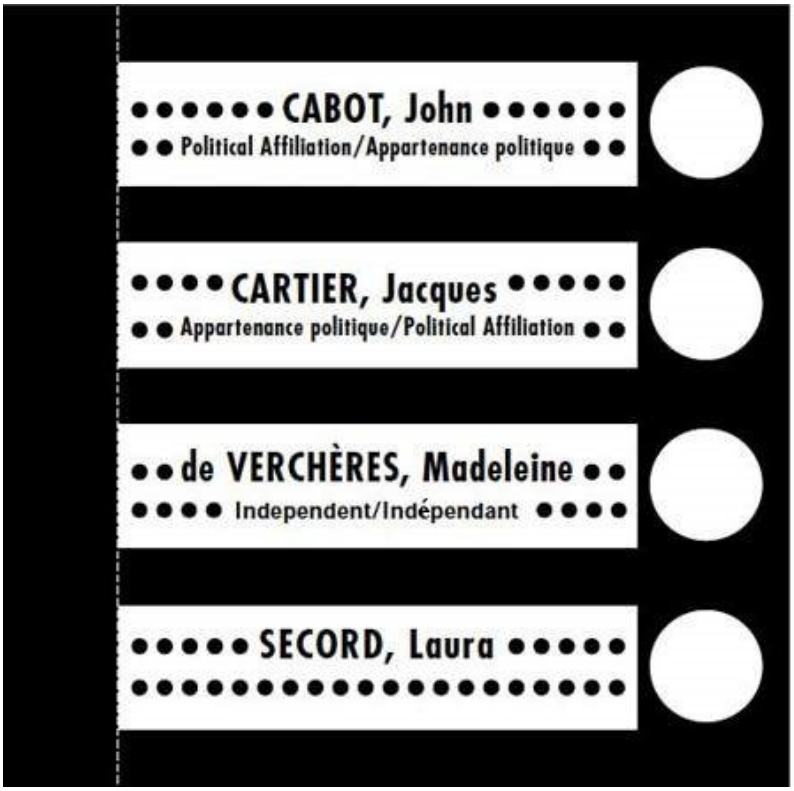

Figure 1. The bubble-ballot design of electoral ballots in Canada. The voter reads the candidate and their party affiliation in the left rectangular box and marks an X in the corresponding bubble next to the candidate of their choice (Elections in Canada, 2019).

Compared to manual paper voting, technology can create a more secure voting system as it can reduce the possibility of result tampering and eliminate voter fraud by minimizing the number of individuals involved in the voting process. Vote counts can, however, be altered by

malicious actors by affecting the recording and tallying of votes, and/or altering or destroying the audit trail used to verify the election results (National Academies of Sciences, Engineering, and Medicine, 2018). In a well-designed, automated election, multiple copies of every data point in both electronic and paper-based systems are created, ensuring that data is never lost, modified, or destroyed, and an audit trail which can be verified (Mugica, 2015).

2.3 Use of Voting Technologies Around the World

At this time internet voting is used in ten countries: Australia, Armenia, France, India, Mexico, Panama, The United States, Estonia, Switzerland, and Canada, to varying degrees of implementation and success in each country (Goodman & Stokes, 2018). While some trials of voting technologies are successful, some trials are ultimately abandoned as countries have not found a way to implement the systems in a way deemed to be safe and accessible while securely maintaining the integrity of the election. Herein, three countries are examined: Estonia, the United Kingdom, and the United States. Estonia was chosen as it is seen as a world leader in electronic government and online voting. The United Kingdom provides an example of hasty implementation which resulted in the failure of the pilot studies of a number of voting technologies. The United States shows how, at times, the implementation of voting technologies can be an attempt at improving democracy after the failure of previous technologies.

2.3.1 Estonia

The intention behind Estonia introducing remote internet voting was to increase the number of voting methods available to voters as well as making the process more simple, convenient, and accessible while dissipating feelings of political alienation (Goodman, Pammett, & DeBardeleben, A Comparative Assessment of Electronic Voting, 2010). Estonia introduced remote internet voting for municipal elections in 2005, national parliamentary elections in 2007, and European Parliament elections in 2009 (Goodman, Pammett, & DeBardeleben, A Comparative Assessment of Electronic Voting, 2010).

One principle of the Estonian government which made implementation of remote internet voting more accepted and successful is that they have been focused on creating an inclusive and citizen-centric culture and infrastructure. Based on this principle, Estonia developed modern infrastructure and government IT programs which supported the development of a national

digital identification system which allows citizens to vote, file taxes, sign documents, obtain digital medical prescriptions and more, all online (Enterprise Estonia). This national identification card, along with the legislated acceptance of digital signatures, made implementation of online voting straightforward. Their online voting process is based on this card used for identification, the possibility of re-voting with only your final ballot counting, and traditional paper voting maintaining priority should a voter vote more than once and using different methods (Goodman, Pammett, & DeBardeleben, A Comparative Assessment of Electronic Voting, 2010).

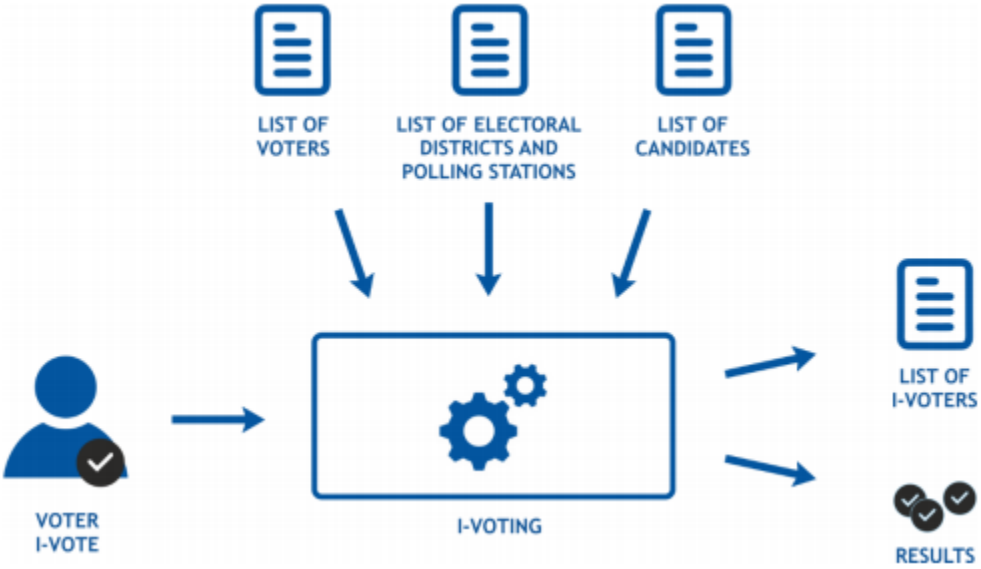

Figure 2. I-voting supports the voting, counting of votes, and announcement of election results processes (State Electoral Office of Estonia, 2017).

I-voting is based on the "envelope scheme" employed for advanced voting and for vote by mail. The vote is digitally placed into an anonymous closed envelope, inside another envelope with the voter's name and signature. Each of the "envelopes" are encrypted. These votes are collected and sorted while eligibility and number of votes per elector is counted (fig. 2 and 3). The votes are then sorted by electoral district, the digital signatures are removed, and the votes are decrypted to allow for counting (State Electoral Office of Estonia, 2017).

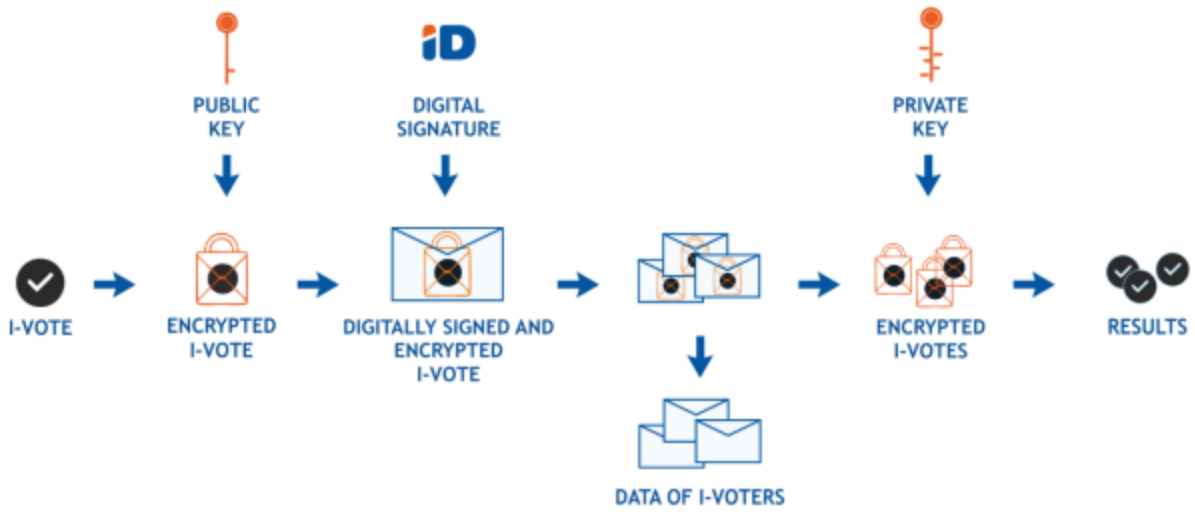

Figure 3. The i-voting system incorporates multiple levels of encryption to ensure the secrecy of the vote (State Electoral Office of Estonia, 2017).

Overall, the adoption of the i-voting system in Estonia has been considered a success, particularly through the metrics of voter adoption and voter turnout. Since the adoption of online voting, the turnout for Estonian parliamentary elections has continued to increase. In 1999, before online voting was introduced, turnout for the parliamentary election was 57.4%. By 2015, turnout for the parliamentary election increased nearly 7% (International Foundation of Electoral Systems, 2018).

Some of the greatest concerns and problems afflicting the online voting system in Estonia have been potential fraud and privacy, overcoming a digital divide, and the accessibility of the system. The issue of fraud and privacy was addressed in the system by allowing voters to cast a vote more than once during an election period to ensure that if they are coerced into voting a particular way, they have the ability to vote again at a later time. The government of Estonia attempted to mitigate any concern over a digital divide based on age, gender, and socio-economic factors by launching a computer training program for adults in 2001, four years before the first election with online voting. As well, more libraries were equipped with computers and internet to increase access to the online system. The issues with accessibility include that while most citizens of Estonia have digital ID cards, they only account for 80% of the population. Furthermore, in order to vote, citizens must a have smart card reader for their computer which, at 20 euros, could be cost prohibitive for some (Goodman, Pammett, & DeBardeleben, A

Comparative Assessment of Electronic Voting, 2010). Another ongoing accessibility issue is the languages available on the voting application. Despite a large Russian-speaking population in Estonia, the voting application is solely available in Estonian, even though the informational website is available in English, Russian, and Estonian (Goodman, Pammett, & DeBardeleben, A Comparative Assessment of Electronic Voting, 2010). Most recently, Estonia has organized a software overhaul of their voting system including end-to-end verifiability to address security concerns after Russian influence on the 2016 US election (Ummelas, 2017).

2.3.2 United Kingdom

In the 2001 General Election, the United Kingdom experienced the lowest turnout for a Westminster Parliament election since the institution of universal adult suffrage (Electoral Commission, 2001). This drove the United Kingdom to experiment with a number of different remote voting technologies in an attempt to modernize the electoral system, attract younger voters and increase overall voter participation through accessibility (Local Government Association, 2002).

The United Kingdom approached voting technologies and e-enabled elections with several principles guiding them: the importance of protecting the secrecy and security foundational to democracy; the focus on e-voting being a complement in elections to increase flexibility and choice in voting methods for voters; piloting of technologies to retain choice and confidence in voting methods; a focus on public education; open source coding of adopted technologies to allow for verifiability and transparency; and openness to amending electoral law to ensure compatibility with 21st century practices and technological additions (Local Government Association, 2002).

Sixteen electoral districts piloted electronic voting methods of voting including touchscreen kiosks, remote internet voting, telephone, SMS text message voting and electronic counting schemes in May 2002. The same pilot studies were conducted in more electoral districts the following year, this time with the inclusion of digital television voting and smart card technology. In both instances, different districts chose to pilot multiple methods simultaneously. Ipswich included remote internet, telephone, and SMS text message ballots available while Sheffield allowed remote internet voting, telephone, public kiosks and text messaging in addition

to regular paper ballots (Goodman, Pammett, & DeBardeleben, A Comparative Assessment of Electronic Voting, 2010).

Ultimately, the enthusiasm for the trials became their undoing. As too many technologies were piloted simultaneously (with the intention of determining the methods which were most effective and usable by the voters), it became too difficult to determine which individual methods were impactful in affecting voter turnout (Goodman & Stokes, 2018). The Electoral Commission terminated all electronic voting trials in 2007 with the government announcing the following year that no methods of electronic voting would be used in the 2009 local and European elections (Goodman, Pammett, & DeBardeleben, A Comparative Assessment of Electronic Voting, 2010). Between the failure of the pilot trials and increased concern over security, and problems with electronic counting systems employed in the 2007 Scottish elections, an end was put to electronic voting in the UK (Goodman, Pammett, & DeBardeleben, A Comparative Assessment of Electronic Voting, 2010).

2.3.3 United States of America

In the 21st century, the major methods of voting in the United States have been paper ballots, punch cards, optical scans (vote tabulators), and DRE (Direct Recording Electronic voting machines) and mechanical lever machines.

Voting reforms began after the boondoggle of the 2000 presidential election. In Florida, there were extensive difficulties with the casting and counting of punch card ballots leading to delays, confusion, and a number of uncounted and miscounted ballots. Punch cards have the highest residual rates, essentially meaning human error in voting, of all the voting technologies in use in the United States. Punch card voting has a residual rate of 2.64% whereas paper ballots are 1.99%, and DREs have a residual rate of 1.68%. In 2002 Congress passed the Help America Vote Act (HAVA) which encouraged states to update their voting technologies. With the passage of HAVA, the Voluntary Voting System Guidelines (VVSG) followed. VVSG, maintained and developed by the U.S. Election Assistance Commission, increased security requirements for voting systems and access to voting systems, particularly for individuals with disabilities (U.S. Election Assistance Commission, 2018). The VVSG currently provides guidelines on the performance and testing of a voting technology's functional requirements, usability and accessibility requirements, as well as hardware, software, telecommunications, and security

requirements, as well as quality assurance and configuration management (United States Election Assistance Commission, 2015).

Mechanical lever machines, a 19th century system in which a voter selects the candidate of their choice by pulling the lever assigned to the candidate, were last used in the 2008 presidential election (United States Election Assistance Commission, 2018). In 2016, 47.7% of all voters who cast ballots in person on Election Day were checked in using e-poll books. E-poll books, or electronic poll books, enable the poll workers to cross a voter off the registry using a laptop, scanner, and the e-poll book software. This technology speeds up the process of manually searching for, and crossing voters off, the paper registry.

The United States operates their elections in a deregulated way in that counties, and at times townships within counties, are free to select the voting method of their choice. In this way, a number of different technologies can be employed within one county, and one state (fig. 4).

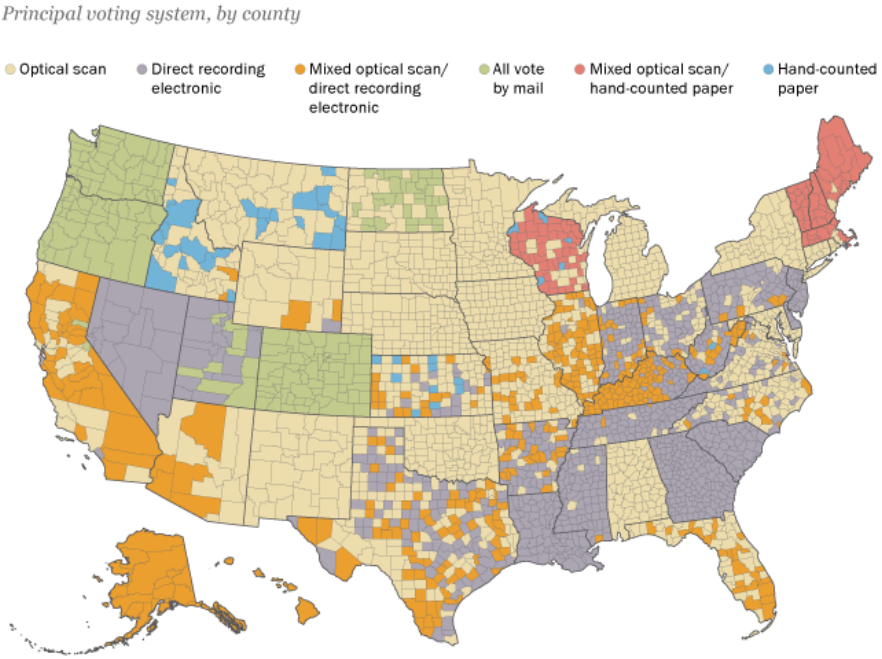

Figure 4. This map illustrates the variety of voting methods used across the United States in the 2016 elections (Desilver, 2016).

Punch card voting technology, used by a third of the American population in 2000, was first instituted for the 1890 Census (Kropf & Kimball, 2012). But like the mechanical lever, it was phased out after the introduction of HAVA (fig. 5).

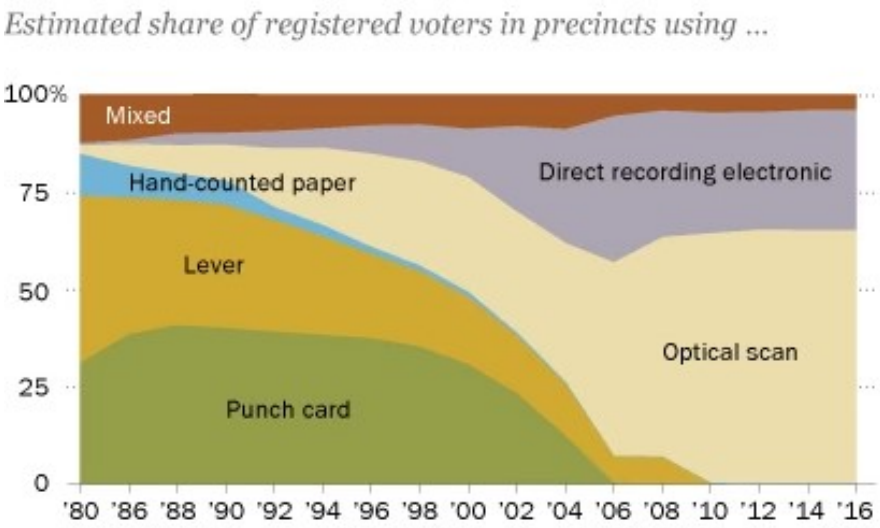

Figure 5. A variety of voting systems are employed across the United States. The use of optical scan technology is increasing, while mechanical levers and punch cards have been phased out (Desilver, 2016).

With a 71.9% increase in jurisdictions' use of e-poll books between 2012 and 2016, as well as the move towards DREs and optical scan voting technology, The United States is moving towards more accessible, efficient, and auditable elections.

2.4 Summary

Governments around the world have tried to implement voting technologies with varying degrees of success. As more countries look to adopt new methods of voting to address low voter turnout, slow reporting of results, add more accessibility, or reduce residual votes, the technologies chosen, and the methods of implementation will be of enormous importance. By seeing where countries have done well and have been able to improve on their system over multiple elections, like in Estonia, and where countries have struggled, like in the UK, other countries will be able to build off the successes and lessons learnt to improve the accessibility and security of their own elections.

Much of the research conducted on the implementation of voting technologies around the world focuses on the overall experiences and outcomes of the adoption of voting technologies. In my research I will focus more on the perceptions of individual voters in Canada and their attitudes towards voting technologies.

Chapter 3: Model design

3.1 The Canadian Experience

3.1.1 Canadian Law

Citizens vote in order to shape the outputs of government in ways which they find meaningful (Franklin, 1999). Overall turnout can be affected by a number of factors, including the competitiveness of an election, candidates' campaign efforts, issues at stake, voter fatigue, weather and traffic (Essensa, Alternative Voting Technologies Report, 2013). But low turnout can occur when voters experience a perceived paucity of choices or an evident disconnect between their vote selections and policy change (Franklin, 1999). While low voter turnout is sometimes felt across all levels of government in Canada, municipal and provincial elections struggle more with lower voter turnout as a higher level of political engagement on the behalf of the voter is associated with voting in lower level elections (Milner, 1997). Citizens may feel more obligated to vote for their federal Member of Parliament as federal elections are seen to have higher stakes, whereas outcomes of municipal elections are seen to have less impact on a voter's life.

At the federal level, all elections in Canada are governed by the Canada Elections Act. While Elections Canada and the current federal government agree they will not be pursuing online voting for the 2019 general election, or at all in the near future, the Canada Elections Act allows for voting technologies to be tested without further changes required for the Elections Act (Canada Elections Act, s. 18.1). Additionally, the Municipal Elections Act in Ontario allows local governments to institute voting technologies they deem appropriate after the passage of a bylaw declaring their intention (Goodman & Stokes, 2018). Prince Edward Island, Nova Scotia, New Brunswick, Manitoba, Saskatchewan, and Alberta also presently allow for municipalities to incorporate voting technologies in their local elections. The passage of these flexible voting laws in the aforementioned provinces allows enormous freedom for municipalities to experiment with voting technologies as they see fit.

3.1.2 Canada

Canada's interest in incorporating voting technologies and voting online has not been with the intention of increasing voter turnout, as it was with Estonia and the UK, but rather with

increasing access to the voting process through the adoption of new technologies (Stein & Vonnahme, 2012). In the 1997 Canadian Election Study, which contained several questions commissioned by Elections Canada, 54% of respondents expressed a willingness to vote using touchscreen computer, 36% expressed a willingness to vote by telephone, and 29% expressed a willingness to vote by computer (KPMG/Sussex Circle, 1998).

After running in the 2015 federal election on a platform supporting electoral reform, Prime Minister Justin Trudeau created a Special Committee on Electoral Reform in 2016. In his address to this committee, Chief Electoral Officer Marc Mayrand said:

> It is undeniable that many Canadians would benefit from the introduction of online or Internet voting. Internet voting would remove barriers and make a vote more accessible for various groups such as voters with mobility challenges, including seniors, those with visual impairments, and Canadians abroad (Special Committee on Electoral Reform, 2016).

The Special Committee held an e-consultation with 22,247 respondents, spoke with cyber security professionals and academics, in addition to hosting open mic sessions across the country. The committee recognized the possibility for online voting to increase accessibility to the electoral process, particularly for those with disabilities, but ultimately the committee recommended that the federal government not move ahead with online voting at this time due to the inability to ensure the secrecy, security, and integrity of the ballot to a sufficient degree with current online voting systems (Special Committee on Electoral Reform, 2016). The question of improving the accessibility of voting for Canadians with disabilities while maintaining the integrity of the voting process was then moved to the Standing Committee on Procedure and House Affairs.

Despite the federal government choosing not to further explore the inclusion of non-paper voting alternatives into the federal elections at this time, in Canada, each province is able to choose their voting technologies for themselves.

This examination of Canada shows the different approaches taken by provincial and municipal governments across the country to implement some method of alternative voting.

British Columbia does not allow for technology in their voting process outside of its use to provide candidates with information about who voted at the end of each day of advanced voting. Elections BC continues to endorse the recommendations of a 2014 Independent Panel on

Internet Voting which recommended not implementing universal internet voting for local or provincial governments at this time (Archer, 2018).

Presently, Alberta allows for vote tabulators to be employed solely during advanced voting periods. Vote tabulators are vote counting machines which can be present either at the voting precinct, attached to a ballot box and counting the votes as ballots are entered, or at the election's returning office where they will count the ballots all together. The electoral district of Calgary-Lougheed took part in a pilot to test electronic poll books and vote tabulators in a 2017 byelection. The use of the technologies was considered a success, but Elections Alberta does not intend a full-scale roll out of these technologies for the next Alberta provincial election (Wood, 2017). Calgary has proposed bylaw amendments ahead of the next municipal election to allow for assistive voting devices, particularly paddles and sip-and-puff machines (Kennedy, 2018). Edmonton conducted a mock trial online voting election in 2012 and at that time city council chose to not pursue internet voting.

For provincial elections, Saskatchewan has yet to include the use of any voting technologies, although electronic poll books were piloted during the Saskatoon Meewasin byelection in March 2017 (Boda, 2017). The pilot was deemed successful and the Chief Electoral Officer has recommended the adoption of electronic poll books and tabulators for the next general election. Both Regina and Saskatoon have adopted the use of tabulators in their municipal elections.

Manitoba has been working to institute an electronic strike-off process for the poll books during advanced voting. Piloted during the St. Boniface byelection in July 2018, the poll book software was used by election workers on a tablet. It was found to be easy to use, sped up the process of finding voters' names and allowed for real-time updating of the voters list (Verma, 2017). Winnipeg has been using vote tabulators supplied by Dominion Voting Systems in municipal elections since 2006 and has progressively incorporated more tabulators at poll locations after incidents of delays of submitting votes (The City of Winnipeg, 2005).

A successful pilot project in the Whitby-Oshawa byelection in 2016 showed tabulators and e-poll books reduced Elections Ontario staffing requirements by 41% and of those surveyed after the pilot, 96% said the voting process was easy with the new technology (Essensa, Proposal for a technology-enabled stafing model for Ontario Provincial Elections, 2016). Ontario adopted the use of vote tabulators and electronic poll books for use in the 2018 provincial general

election. Vote tabulators were used in 50% of the polling locations on election day and the majority operated successfully, with only some instances of long lines due to the additional time required for the tabulators (Dunham, 2018). The additional time was often due to having one tabulator at a voting precinct which all ballots must be entered into in front of the voter who cast the ballot, when previously there would be a ballot box at each poll within a precinct. After extensive research, Ontario has not proceeded with any form of networked voting at this time as it has not found a solution determined to protect the integrity and secrecy of the ballot to an acceptable extent (Essensa, Proposal for a technology-enabled stafing model for Ontario Provincial Elections, 2016).

Since the Ontario Elections Act allows municipalities leniency in the ways in which local governments choose to administer elections, by simply passing a by-law, many municipalities have adopted a wide array of voting technologies including e-Poll Books, tabulators, and internet voting (Goodman & Stokes, Reducing the Cost of Voting: an Evaluation of Internet Voting's Effect on Turnout, 2018). Markham has had the most success in implementing voting technologies for its municipal elections. Markham first adopted voting technologies for the 2003 election with the intent of leveraging technology to increase voter engagement (Huycke & Tecsa, 2012). In this election, the town instituted optical scan vote tabulators, online voting for the advanced polls, and DREs to enhance accessibility. Election Systems and Software (ES&S) have supplied tabulators for Markham since 2003 and supplied all technology for the 2003 and 2006 municipal elections. The town contracted Intelivote, another voting company, in conjunction with ES&S in 2010. Markham has employed Scytl, a European voting company which specializes on online voting, for its online voting needs since 2014. To vote online in Markham, the user must register to vote online after receiving their Voter Information Package (fig. 6). This package included a unique PIN which the voter would use in conjunction with their date of birth to create a personal passcode in order to register.

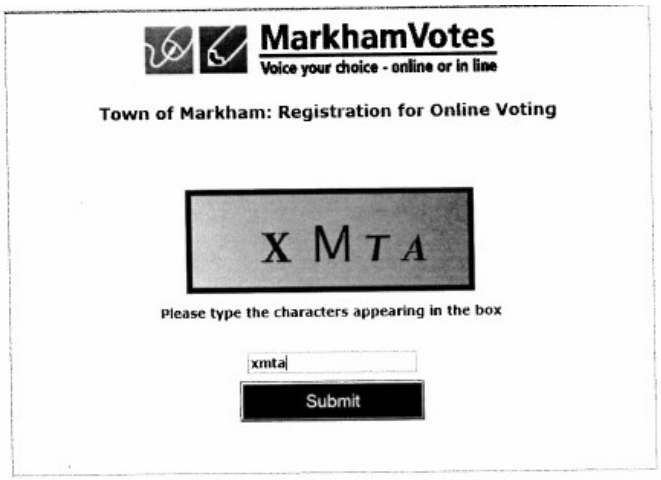

Figure 6 (a). Step 1 in the Markham online voting process asks the voter to enter the CAPTCHA (Huycke & Tecsa, 2012).

Figure 6 (b). Step 2 asks the voter to enter their date of birth and the registration PIN found in the voter's Voter Information Package (Huycke & Tecsa, 2012).

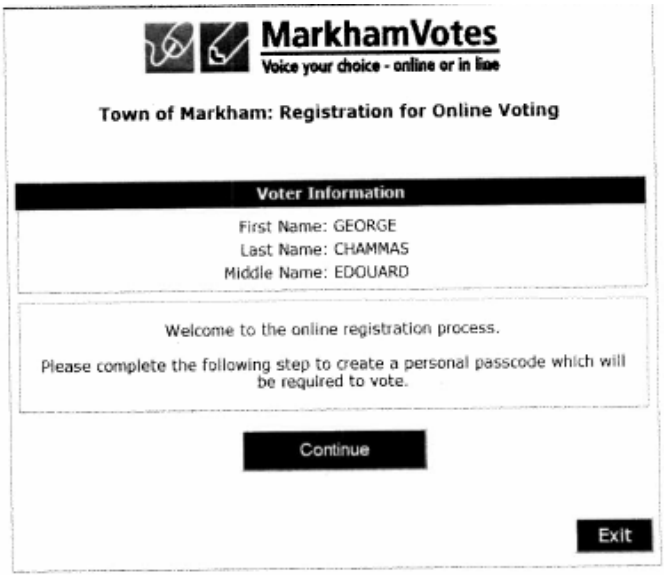

Figure 6 (c). Step 3 confirms the voter's identity. (Huycke & Tecsa, 2012).

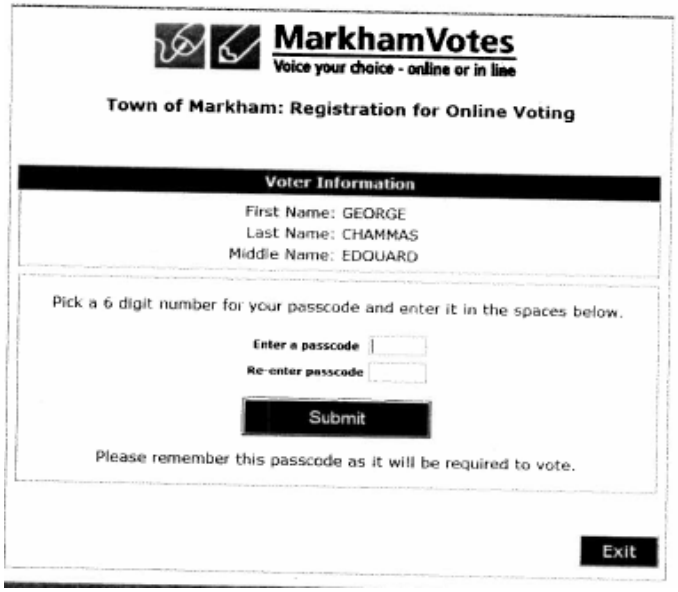

Figure 6 (d). Step 4 asks the voter to select a passcode which will be used later to access their account when they vote (Huycke & Tecsa, 2012).

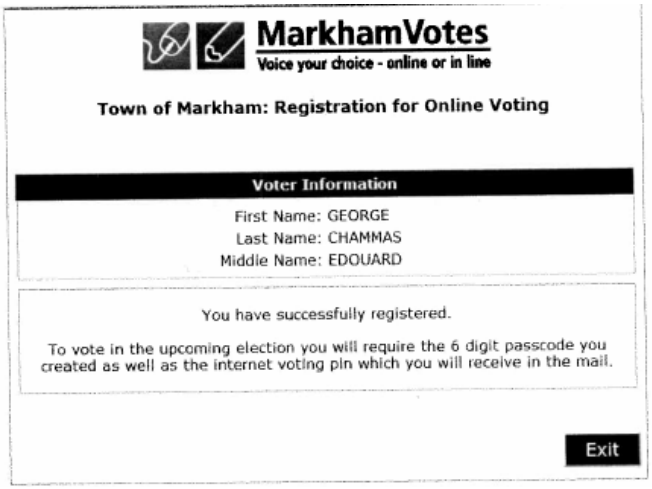

Figure 6 (e). Step 5 confirms the voter's registration to vote online and informs them of next steps required to vote (Huycke & Tecsa, 2012).

In the 2018 Ontario municipal elections, 51 municipalities had to extend voting hours late into the night or extended the voting period by a full 24 hours. Each of these municipalities was using Dominion Voting as their online-voting service provider. Blame was ultimately placed on a Toronto-based company for limiting the incoming traffic to the online voting platforms.

Québec had allowed electronic voting for 10 years before experiencing difficulties with the technology. In November 2005, 81 of 1106 Québec municipalities used an electronic voting system for their municipal elections (Michaud, 2006). 75 municipalities chose to implement electronic ballot boxes to count paper ballots, while 58 municipalities implemented full voting machines (Le Directeur Général des élections du Québec, 2016). Five different machines were introduced in this election: the Accu-Vote ES 2000 (fig. 7 (a)), the Perfas-Tab (fig. 7 (b)), the Perfas-Tab 2 (fig. 7 (d)), the Perfas-MV (fig. 7 (c)), and the Votex (fig. 7 (e)). The electronic voting machines (the Perfas-MV and the Votex) as well as the vote counters (the Accu-Vote ES 2000, and the Perfas-Tab) experienced widespread failure (Le Directeur Général des Elections de Québec, 2006). Many of the systems broke down and were faced with long delays in repairs. This led to delays in voting and in counting, which counteracted the purpose of their introduction. This widespread failure of the electronic voting systems caused a moratorium to be placed on alternative voting methods in all Québec elections with the passage of Bill 55 in 2006 (Blanchet, 2006). It was determined that the government and the polling clerks were not adequately knowledgeable about the risks of electronic voting systems nor were they adequately

trained to address the difficulties experienced with the selected systems. This moratorium still stands.

Figure 7 (a). Accu-Vote ES 2000 vote counter (Le Directeur Général des Elections du Québec, 2006).

Figure 7 (b). The Perfas-Tab vote counter (Le Directeur Général des Elections du Québec, 2006).

Figure 7 (c) . The Perfas-Tab 2 vote counter (Le Directeur Général des Elections du Québec, 2006).

Figure 7 (d). The Perfas-MV DRE voting machine (Le Directeur Général des Elections du Québec, 2006).

Figure 7 (e). The Votex DRE voting machine. (Le Directeur Général des Elections du Québec, 2006)

New Brunswick has had legislation in place to allow for alternative electronic voting methods since 2004, with the first pilot project being run during the 2004 Saint John municipal election (Quinn, 2008). The pilot project was found to be successful, resulting in changes to New Brunswick's *Municipal Elections Act* and the institution of the Dominion Voting tabulation machines province-wide in the 2008 municipal elections. The 2014 general election was the first year in New Brunswick in which tabulators were used to count all ballots cast in the provincial

election. While the intention behind introducing voting tabulators to the voting process was to reduce the time required to count and report votes, the opposite occurred in the general election (Lewis, Bateman, & Desserud, 2017). In order to expedite the reporting of results from the closed and secure network of the machines to the media outlets, Elections New Brunswick used separate file transfer software that did not come from Dominion Voting Systems. This software did not properly operate with the vote tabulators, resulting in delays. This glitch did not affect the ability of the systems to accurately count votes (CBC News, 2014). New Brunswick continues to use Dominion Voting Systems as the supplier of their vote tabulator systems but is now using mobile modems to transmit the results (Gill, 2018).

In 2011 Nova Scotia updated their election laws to allow for pilot projects to test new processes, procedures, equipment, and technologies (Elections Nova Scotia, 2018). In 2008 four municipalities, including Halifax, employed internet voting for its municipal elections. In 2012 that number had risen to 15 municipalities and Halifax added a telephone voting option (Essensa, Alternative Voting Technologies Report, 2013). In this system, the voter had to enter a PIN sent by mail as well as their date of birth in order to access the ballot. These methods were only used on advanced polling days (Essensa, Alternative Voting Technologies Report, 2013). Some of these municipalities saw a greater turnout, but this was not a consistent result amongst participating municipalities (Coyle, et al., 2013). While Scytl provided the online voting platform to Halifax in 2012, in 2016 Scytl and Intelivote partnered to provide alternative online voting solutions to the 25 participating municipalities of Nova Scotia heading into their municipal and school board elections (Scytl, 2016). While alternative voting methods accounted for 60% of votes cast, 2016 resulted in the lowest voter turnout since 2000, with only 31% participation, showing that voting technologies alone have not improved voter turnout in Halifax (Arjoon, 2018).

Nova Scotia has yet to pilot any voting technologies in their provincial general elections, but they are aiming to adopt electronic poll books for the next general election scheduled for 2021 (Temporale, Annual Report of the Chief Electoral Officer, 2018). As part of their strategic plan for 2018-2022, Nova Scotia intends to implement early voting eBallots, e-poll books and eVoting for military members (Temporale, Elections Nova Scotia Strategic Plan 2018-2022, 2018).

In Prince Edward Island, the Municipal Government Act allows for municipalities to employ electronic voting systems (Legislative Counsel Office, 2017). In an October 17, 2016 provincial by-election in Summerside-Wilmot, P.E.I. piloted an electronic voters list and tabulator to help speed up the voting process for in-person voting, while also piloting telephone and internet voting. 80% of votes cast used the telephone or online option (Macleod, 2016). The Chief Electoral Officer cited accessibility as one of the main reasons for adopting internet voting. To vote online, voters were directed to a website to enter their date of birth and a unique PIN listed on their individual Voter Information Card received in the mail. Once their identity was confirmed, the voter was presented with an electronic ballot to submit. The telephone system worked in much the same way. After entering their date of birth and PIN, the voter would hear a computer-generated voice offering their voting options, which the voter would select using the keypad (Macleod, 2016).

From October 29 to November 7, 2016, P.E.I. held a plebiscite on electoral reform, which was Canada's first ever province-wide vote held online. The electronic system was administered by Simply Voting, a major Canadian internet voting vendor (Wright, 2018). Voters also had the ability to cast a paper ballot in this plebiscite. Those ballots were counted by means of tabulators supplied by Election Systems & Software Canada (Pitt, 2016). After the plebiscite, the province required an independent audit to be performed by electoral IT experts to determine the security of the vote. The experts determined that while P.E.I.'s plebiscite "maintained a high level of integrity," this was despite the major risks involved in holding a solely online vote. Therefore, at this time, the province is not looking to officially introduce electronic voting to the provincial general elections.

Newfoundland and Labrador has no legislation in place to allow for pilot projects, online voting, or the use of voting technologies. In February 2019, the Newfoundland and Labrador legislature launched an all-party committee to research political reform, including the possibility of allowing online voting in future provincial elections (Cowan, 2019). No municipalities have introduced voting technologies at this time, but for the next municipal election slated for 2021, St. John's city council has approved use of Dominion Voting's ImageCast Precinct with assistive devices to improve accessibility (City of St. John's, 2019). This device allows the voter to autonomously and secretly cast their ballot using an Audio Tactile Interface (an accessible

keyboard with changeable face overlays), paddles (large pressable buttons), or a sip-and-puff mechanism (an air pressure measurement using inhales/exhales into a straw).

3.2 Security

Security is one of the most important aspects of voting, regardless of the method, as it ensures a fair and democratic election. But, the most vulnerable type of election is that which does not incorporate technology at any stage of the process (Mugica, 2015). An election which uses paper at every stage of the process and includes a manual vote is susceptible to human error and tampering. It also typically results in single copies of each vote and a weak audit trail, which makes verifiability challenging (Mugica, 2015).

E-Mergent Management Research conducted a study of internet voting security risks for the town of Markham. The study came up with a list of security recommendations which an internet voting vendor applying to work for Markham should adhere to. The most basic security suggestions say that any company whose bid is selected for a contract should have up-to-date methods and technology for detecting attack attempts, and the ability to prevent and correct pharming and man-in-the-middle attacks (E-Mergent Management Research, 2010).

One aspect of security touched on by E-Mergent is that attacks on electoral integrity are in fact illegal. While this is not likely to be a deterrent to foreign actors, which are a growing threat, it could be an effective deterrent for Canadians looking to influence, affect, or disrupt a Canadian election. While municipal elections would likely not be of great enough importance to foreign actors with an interest in the outcome of Canadian elections, provincial and federal elections may be of greater consequence and therefore pose a threat to the security of Canadian elections should technology be adopted.

The final issue mentioned is the use of a proxy by ineligible voters to vote in an election. While this risk could be mitigated by sending identity verification information by mail, the information sent out would likely be stored by the elections department conducting the election which could also be susceptible to attack. By having localized servers storing the election data, it would be more likely that any irregular behaviour may be more likely to be caught.

Election Systems & Software CEO Tom Burt stated in 2019 that in light of growing security concerns, ES&S will no longer sell voting technologies which do not create a paper audit trail as the primary voting device in a jurisdiction. He called on the United States Congress

to pass legislation to establish a more robust testing program for all voting machines used in the U.S, and highlights the importance of having physical paper records of votes cast (Burt, 2019).

3.3 Accessibility

Accessibility of voting impacts citizens' ability to vote and participate in democracy. In Canada, some citizens are currently limited in their ability to fully participate in democracy based on their current life circumstances, or because of a physical or mental disability. Accessibility in voting is not just for those with accessibility needs, it is also for those who find themselves often away from the electoral district in which they reside. Post-secondary students, military members, snowbirds, and people who often travel for work will find themselves with limited options for voting simply because they cannot be in the required electoral district for election day or for the advanced polls (Essensa, Alternative Voting Technologies Report, 2013).

The United States' Department of Defense developed an online vote portal pilot program, called the Secure Electronic Registration and Voting Experiment (SERVE), to allow military members to vote more easily during postings, deployments, and taskings. The SERVE system is composed of four components: the voter application, the network server, the vote storing server, and the vote counting server (Awad & Leiss, 2011). Due to the inability to ensure the security and integrity of the system, the program was cancelled not long after its 2004 launch (Greenhalgh, Goodman, Rosenzweig, & Epstein, 2018). Currently 24 states, plus the District of Columbia allow military members to cast votes using email, fax, or an online portal. In 2016, 100,000 military members cast their ballots electronically (Gal & Panetta, 2018).

People with disabilities have limited options for voting in Canada. The accessibility aids approved for voting include: a magnifier with a light, a voting screen which lets in more light, sign language interpretation which must be requested in advance, a Braille list of candidates, a tactile and Braille voting template, a large-print list of candidates, and the use of a helper (Elections Canada, 2019). Due to the limits of these devices, voters with disabilities have been lobbying governments to adopt more electronic methods of voting which would allow them to vote unassisted (Mugica, 2015). To improve the autonomy of voters with disabilities, voting technologies have been built with accessibility in mind. All Canadian voting technology companies abide by the Web Content Accessibility Guidelines 2.0 (WCAG 2.0) to ensure greater accessibility for more users. There accessibility devices available include sip-and-puff,

headphones, and paddles, which enable voters with disabilities to vote secretly and autonomously (fig. 8).

Figure 8 (a). The ImageCast Evolution by Dominion Voting offers a voter a handset and headphones in order to cast their vote (Dominion Voting, 2014).

Figure 8 (b). A headset and paddles can also be used for a voter with limited mobility (Elections New Brunswick)

Figure 8 (c) (d). Sip and puff, in conjunction with a headset, is another option for voters with disabilities (Elections New Brunswick)

3.4 Organizing Reoccurring Themes

In order to organize the myriad of concepts encountered while researching for the literature review, I created an affinity map. It gave me the opportunity to pull out sections of papers I had read to compare them and group them by theme and subtheme on individual post-it notes. By sorting and labeling the similar concepts, it provided a clearer understanding of common concepts and reoccurring issues in the literature (fig. 9). The most common themes which arose around the topic of voting technologies were: accessibility, usability, convenience, usefulness, accuracy, trust, and security. These were factors often mentioned in relation to the acceptance of a voting technology.

As I continued reading related research, it became clear that there were established relationships in this field with the Technology Acceptance Model (Davis, Bagozzi, & Warshaw, 1989).

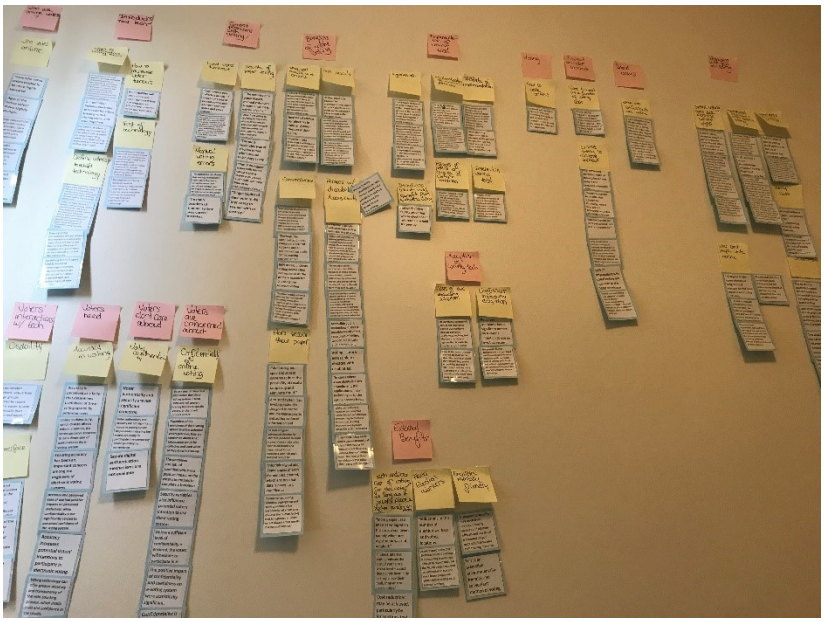

Figure 9. Creating an affinity map with sources, concepts, and quotes found while researching my literature review ensured a clearer understanding of relationships between concepts.

3.5 Technology Acceptance Model

The Technology Acceptance Model (TAM) was developed by Fred Davis as an extension of Ajzen and Fishbein's Theory of Reasoned Action (Fishbein & Azjen, 1975). The Theory of Reasoned Action is used to predict how individuals' behaviours are based on their pre-existing attitudes. The TAM applies this concept to the acceptance of technology, with its key purpose being to provide "a basis for tracing the impact of external factors on internal beliefs, attitudes, and intentions" (Davis, Bagozzi, & Warshaw, 1989).

The TAM suggests there are two factors which impact a user's acceptance and adoption of technology: the technology's Perceived Usefulness and its Perceived Ease of Use. Perceived Usefulness is the degree to which a user believes a piece of technology will help them do their job easier. In the case of this study we are using it to mean the degree to which a user believes technology may help them vote more easily. Perceived Ease of Use is the understanding that despite the ability of a technology to make a user's life easier, the difficulty of using the system may outweigh the benefits gained. So therefore, all else being equal, Davis claims a technology which is perceived to be easier to use is more likely to be accepted and adopted by users (Davis, 1989). This results in the TAM suggesting that computer usage is determined by the user's Behavioral Intention to Use (BI) the system, with BI being determined by the user's attitude toward using the system as well as the perceived usefulness of the system (fig. 10) (Davis, Bagozzi, & Warshaw, 1989).

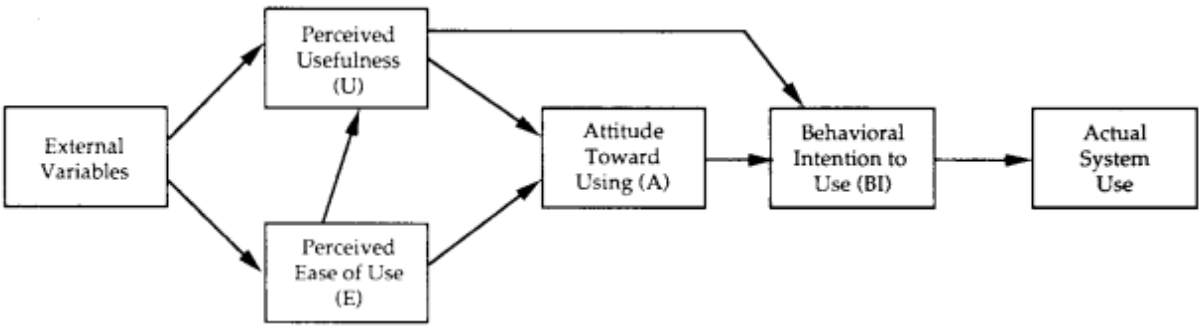

Figure 10. The Technology Acceptance Model describes a user's process to technology adoption (Davis, Bagozzi, & Warshaw, 1989).

The Perceived Usefulness and Perceived Ease of Use variables have been used in the model in my study as they relate to the adoption of voting technologies.

3.6 Trustworthiness

Trustworthiness was determined to be an integral factor in the acceptance of voting technologies as it is related to the acceptance of technologies and government services. Carter and Bélanger, in a study on the utilization of e-government services, determined that trustworthiness is a significant indicator of citizens' intention to use state e-government services (Carter & Bélanger, 2005). Government is required to provide services for all regardless of education or ability, which can make the design of services more challenging. Hart-Teeter found that in the United States, while citizens believe e-government services to be beneficial, they are concerned about sharing their personal information online for fear of data being misused or compromised (Carter & Bélanger, 2005).

McKnight et al. identified components of trusting beliefs to be benevolence, integrity and competence of the vendor, which in this case would be the government (McKnight, Choudhury, & Kacmar, 2002). Therefore, the user of a voting technology would need to feel the government is acting in a way which is benevolent, and with integrity and competence in order to trust it. As well, Mcknight et al.'s understanding of institution-based trust, that "one believes the necessary impersonal structures are in place to enable one to act in anticipation of a successful future endeavor" (McKnight, Cummings, & Chervany, Initial Trust Formation in New Organizational Relationships, 1998). McKnight et al. go on to say that "structural assurances, defined as the belief that success is likely because such contextual conditions as promises, contracts, regulations, and guarantees are in place" (McKnight, Cummings, & Chervany, Initial Trust Formation in New Organizational Relationships, 1998). These structural assurances are important in the acceptance of voting technologies as it is the trust of the government that the voter is relying on when encountering a new technology. The benevolence, integrity, and competence, which the government exhibits in the services it provides, the legislation it passes and enforces, and how its representatives act with citizens carry over to the new endeavours or technologies it enacts.

Carter and Bélanger illustrated their understanding of how the TAM and Rogers' Diffusion of Innovation (DOI), in addition to McKnight's concepts of trust influence a user's intent to use (fig. 11).

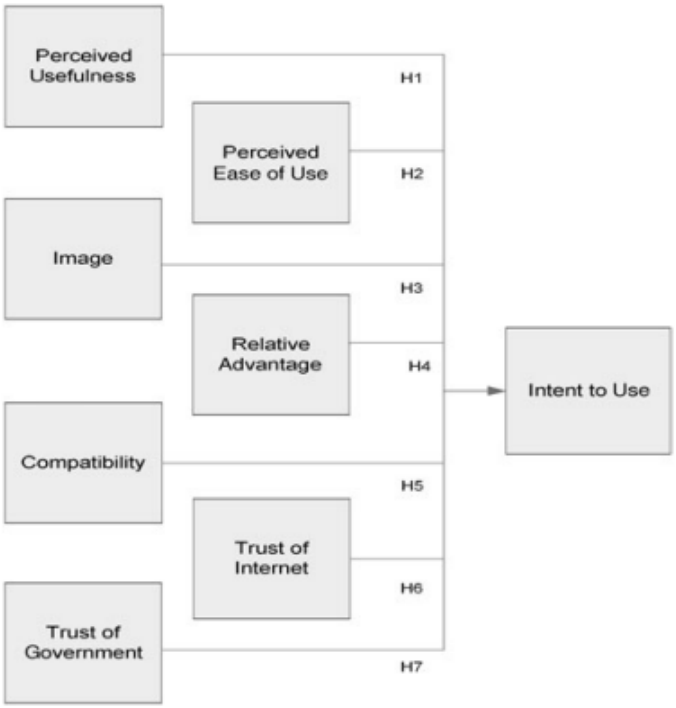

Figure 11. Carter and Bélanger's model illustrating a user's intent to use (Carter & Bélanger, 2005)

Choi and Kim name electronic voting technologies as trusted systems, or a system "whose failure may result in violating security principles" (Choi & Kim, 2012). Voting technologies must ensure that only authorized users are able to access the stored information and cannot be altered. Choi and Kim follow the trusted systems literature for their study, while I am including trust of institutions in addition to trusted systems (internet).

3.7 CIA Triad

The core principles of information security are confidentiality, integrity, and availability, known as the CIA triad. Confidentiality means ensuring the privacy of data. This can be achieved through encryption, which ensures unauthorized personnel cannot access the plaintext data (Sherman, et al., 2017). Integrity is the reliability of the technological system to protect data and detecting whether it has been modified. Availability refers to whether the system is accessible when a user wishes to utilize it and is not subject to regular unplanned downtime.

While becoming subject to increasing scrutiny for its limited scope, the CIA triad has been used as the textbook definition of security in information systems (Lundgren & Moller, 2019), and as such, will be used as the basis of the understanding of security in this study.

The CIA triad strongly applies to voting technologies as it does with other trusted systems including online banking, in that major factors in the function of the technology itself is its confidentiality, integrity, and availability. If a voting technology is not available, secure, and private, it is useless.

The basis of western democratic elections is the secret ballot, which exemplifies confidentiality. Confidentiality, integrity, and availability have been deemed to be adequate (but by no means perfect) with the current paper voting system in Canada. If the triad cannot be ensured in an election using voting technologies, the technology will not be adopted federally, provincially, or municipally.

3.8 Building the Model

The next step after determining the common concepts was determining the relationships, if any, which existed between them. This led to the drawing of my first model (fig. 12). What was unclear after the drawing of the model, was where exactly security and authenticity would fit in. Security of voting technologies was heavily referenced throughout the literature, as seen by the additional inclusion of the confidentiality, integrity, availability triad. Authenticity was also deemed to be an important factor by users, but how security and authenticity would fit in with the other factors was not immediately clear.

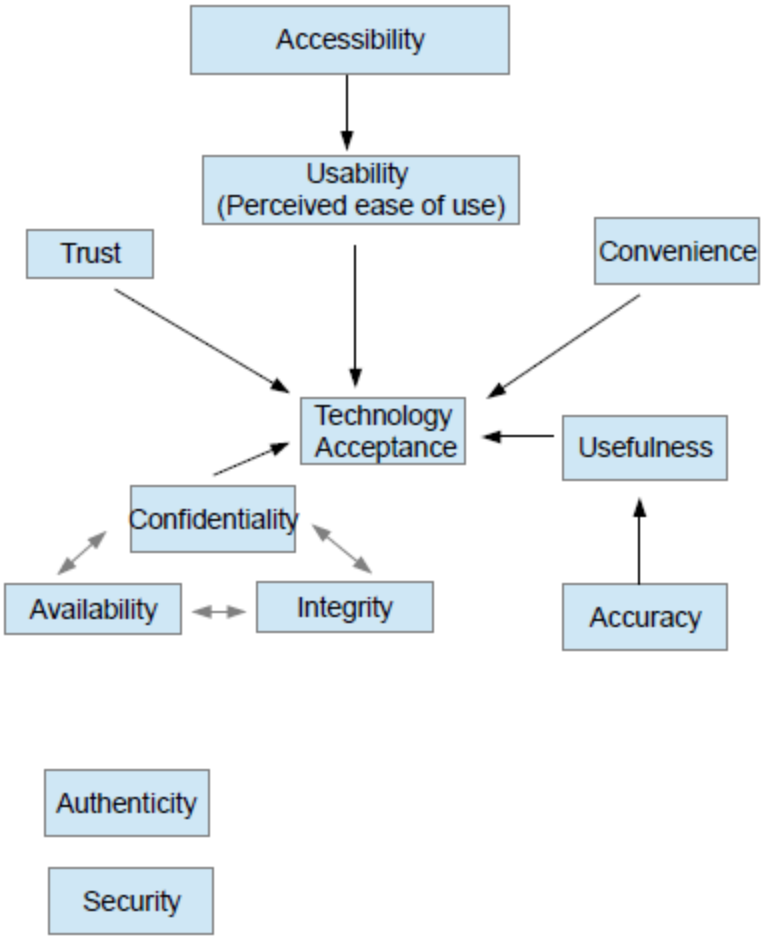

Figure 12. The first iteration of the model drew tentative relationships between the concepts found in the literature review.

After drawing the model and attempting to determine relationships between the concepts, it became clear that the model and literature were still based in the Technology Acceptance Model and therefore had the ultimate goal of technology acceptance. In order to understand how Technology Acceptance could be achieved, it was necessary to understand why and how each factor was related to each other. By explaining more clearly the relationships between the factors it helped to reason out the relevance of a factor to the model.

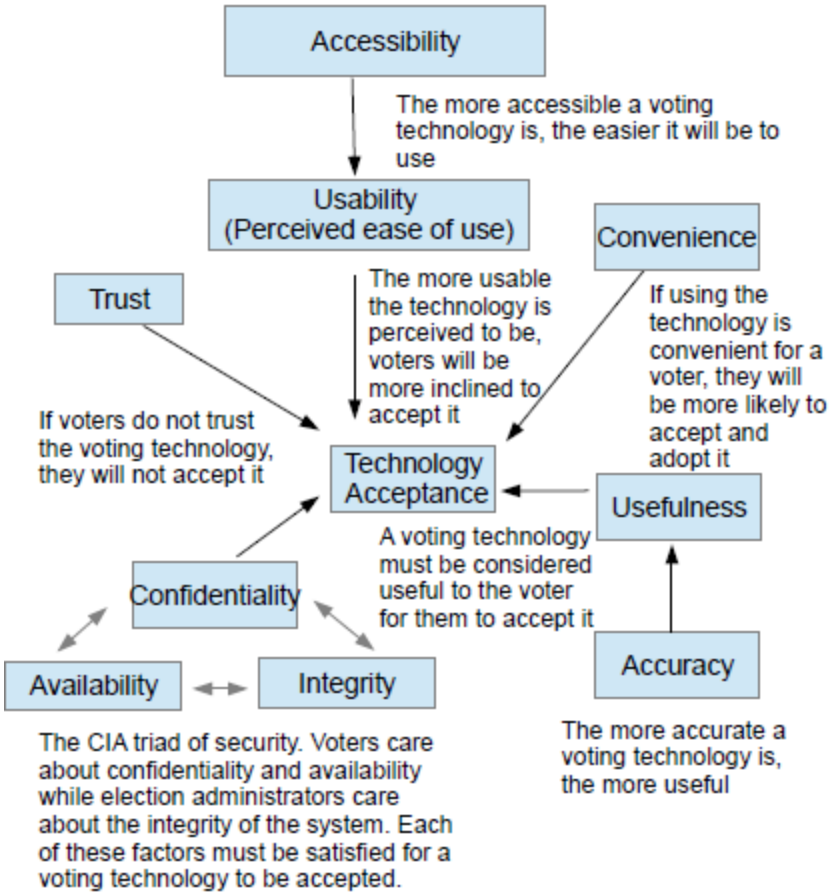

Figure 13. The second iteration of the model explained the relationships between the factors.

The second iteration of the model (fig. 13), placed a focus on the impact the factors had on each other. In this version of the model, Security and Authenticity were removed as they had no clear place in the model and there were no apparent relationships between them, and the factors already included. While the concepts were important, they were also vague and did not suitably relate to the other factors in the model.

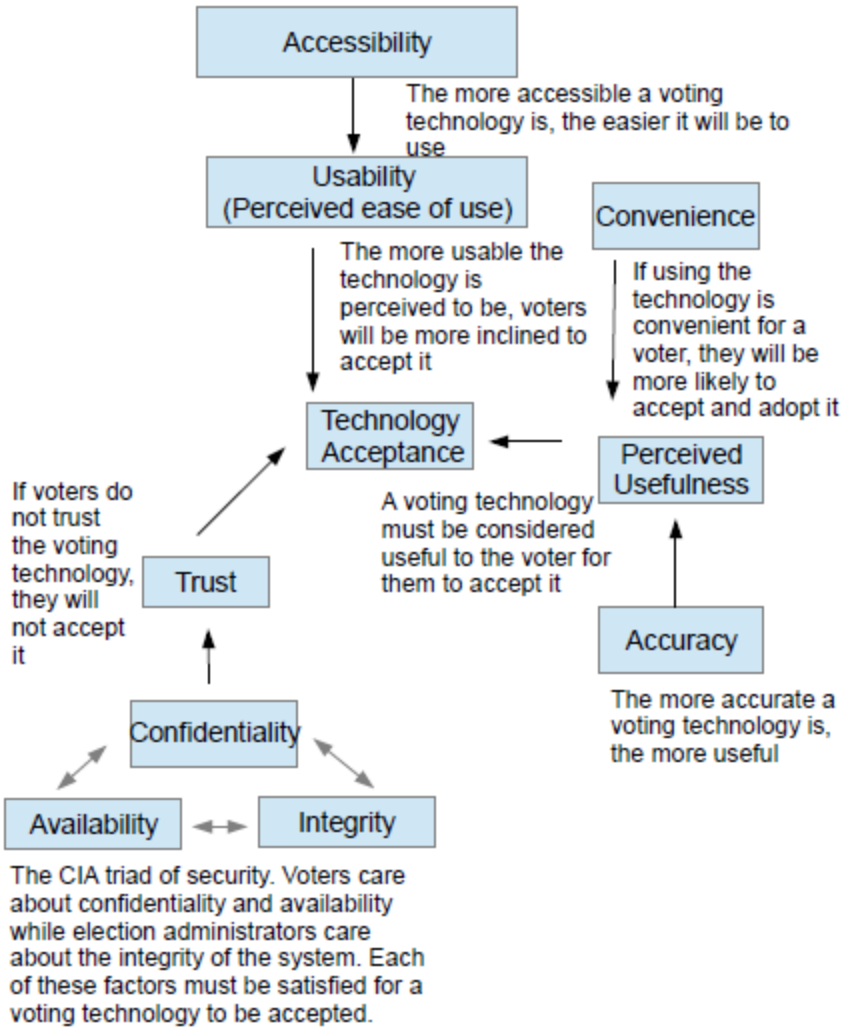

Figure 14. The third iteration of the model included further explanation and slight alterations

By the third iteration (fig. 14), the relationships between the factors became more solidified and apparent. Through further reading and development of the model, the relationship between the CIA triad and Trust became clearer. If a system lacks the confidentiality, integrity and availability required in a functional technological system, how can the users trust it? If the users cannot trust the technology, how can they accept it?

This iteration also leaned more towards the TAM. While the model is based on the TAM, as seen through the Technology Acceptance, Perceived Ease of Use, and Perceived Usefulness factors, it also includes other factors. In previous versions, Perceived Usefulness was listed solely as Usefulness but by version 3 it became clear that it was necessary to include the

perception which is the factor included in the TAM. A user cares about whether they consider a technology to be useful to them, rather than an objective concept of usefulness.

Here is also where Convenience became tied to Perceived Usefulness rather than directly to Technology Acceptance. While Convenience does likely influence Technology Acceptance, it is more closely tied to the Perceived Usefulness of a technology. Things that are seen as useful are often convenient. Convenience then impacts the Perceived Usefulness of a technology.

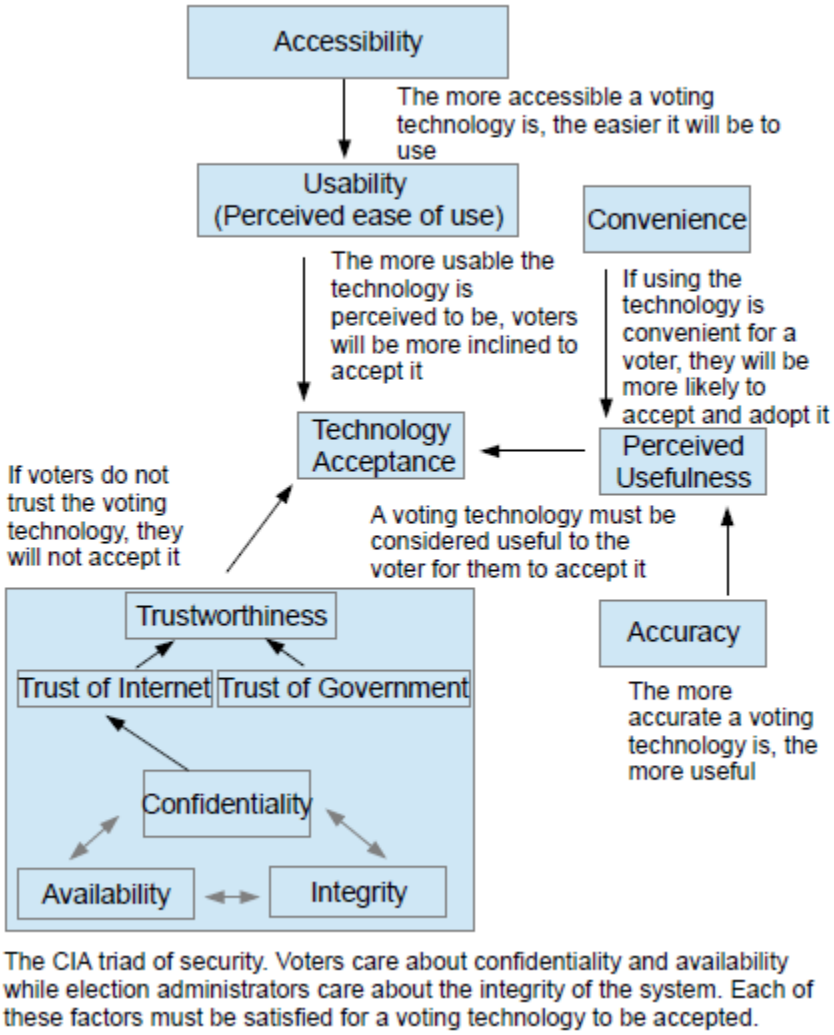

Figure 15. The fourth and final iteration of the model showing the factors required by a voting technology in order to be accepted by voters.

Upon further reading and reflection, more relationships emerged and solidified (fig. 15). The CIA triad could not solely impact Trust as it was not entirely clear what Trust could mean. Who or what does a voter trust when they vote? They are trusting their democratic system, the

poll workers, their method of voting, and their government. The previous model highlighted the CIA triad as having an impact on Trust, referring mostly to the voting technology the voter may use, but when incorporating technology into a democratic election, the voters must also have trust in their government that the technology will effectively carry and/or count their vote.

The Accessibility and Usability (Perceived ease of use) factors have remained the same since the first version of the model. This is because a major component of the literature around the development, use, and acceptance of voting technologies focuses on accessibility. Accessibility is a major component of Usability and therefore is expected to positively impact Technology Acceptance.

Chapter 4: Study

The aim of this study is to gain a better understanding of the factors required for a voting technology to be accepted by Canadians, as well as the attitudes and concerns of Canadians in relation to voting technologies. This study was approved by Carleton University Research Ethics Board-B, Clearance # 111184 (Appendix A).

4.1 Participants

The only requirements to participate in this study were to be 18 years of age and a Canadian citizen, the same requirements for voting in Canada. A total of 124 participants took part in this study. Of these participants, 107 were recruited online through TurkPrime, while 17 were recruited through word of mouth at Carleton, and the Southern Alberta Institute of Technology.

The 107 participants who were recruited online were remunerated $2 for their time, paid through TurkPrime. They were asked to fill out a questionnaire about their attitudes towards voting technologies.

The 17 participants recruited through Carleton, SAIT, and through word of mouth, were remunerated $15 for their time. The in-person participants were offered more money as they took part in an extended version of survey, which involved the original questionnaire and an additional interview, totaling roughly 30 minutes in length.

4.4.1 TurkPrime

After posting the questionnaire on Limesurvey, I used TurkPrime to recruit participants from across Canada to complete the study. TurkPrime is an online platform which works in conjunction with Amazon Mechanical Turk. It is a platform which can be used to find workers to act as participants in studies. It connects to an Amazon account, which allows the researcher to pay money to Amazon to pay each of your participants the amount you set for the completion of the desired task. Litman et al. have advocated for the use of the platform for social science research due to the ability to complete research more quickly and inexpensively while improving data quality (Litman, Robinson, & Abberbock, 2017).

By using TurkPrime, the participants personal information remains entirely anonymous to the researcher as TurkPrime acts as the mediator. All that is known by me about the participants is that they are in Canada in addition to the demographic information they disclose in the demographics section of the survey. When Mechanical Turk workers, or "Turkers" take on the study as a job they are then directed to the study hosted on Limesurvey by a link.

After receiving roughly 105 participants through TurkPrime, participants were recruited through posters and word of mouth to complete the questionnaire and participate in an interview.

4.2 Design

4.2.1 Online Questionnaire

The questionnaire is composed of four sections: demographics, the Ten Item Personality Inventory (TIPI), Security Behaviour Intentions Score (SeBIS), and Technology Acceptance Model (TAM)-based voting technology-specific questions. The online questionnaire took roughly 15 minutes to complete.

The TAM is a core component of this study as it informs much of the research behind why users choose to adopt certain technologies. The third part of the Likert-based questionnaire focuses on the core concepts of the TAM. The questions are variations of questions found in Voter Intention to Use E-Voting Technologies: Security, Technology Acceptance, Election Type, and Political Ideology (2012) and The Utilization of e-Government Services: citizen trust, innovation and acceptance factors (2005), as well as some additional questions I created as seen in Table 1 .

The demographic sections of gender, age, education, household income, and voting city were decided on because of the of the comparable research in the voting technology field. From the studies conducted in Markham based on the results of their adoption of voting technologies, a relationship has been seen between use of voting technologies and household income and higher education. The inclusion of the demographic information in this study is to see if those findings are similar outside of Markham. The final demographic question asks the participants in which city do they vote, so as to see how responses may vary by region.

The TIPI was included as a method of measuring the Big Five personality dimensions (appendix C). While the TIPI is found to be somewhat inferior to the BFI (John, Naumann, & Soto, 2008), it is a reasonable stand-in when a study requires a quick personality measurement

(Gosling, Rentfrow, & Swann Jr., 2003). The Big Five personally traits, also known as the five-factor model, consists of Openness, Conscientiousness, Extraversion, Agreeableness, and Emotional Stability (John & Srivastava, 1999). The theory is that every individual has a personality score for each of these traits. The TIPI was included as it would be a beneficial addition to this study as a measurement to compare with Canadians' attitudes towards voting technologies. This could show whether individuals who score higher for Openness or Conscientiousness show more acceptability of voting technologies. In this way it provides a clearer understanding of what it is about Canadians that is making them more open or closed off to voting technologies. The TIPI constitutes questions 1-10 in the questionnaire.

The SeBIS was included in the survey as it is a measurement tool for user security behaviour intentions. The tool was made by surveying the most common cyber security advice subject matter experts offer, and then constructed a Likert scale by which users could gauge their compliance (Egelman & Peer, 2015). Since one of the major components of voting technology is the security of the system to ensure a fair and democratic election, users' approach to online security could influence how they view and interact with voting technologies. Gaining a better understanding of users' overall comfort with online security could aid in our understanding of Canadians' likelihood to adopt voting technologies. The SeBIS constitutes questions 11-26 in the questionnaire.

4.2.2 Hypotheses

The hypotheses were drawn primarily from the relationships between factors in the model as seen in Chapter 3. Additional hypotheses were created to further examine concepts encountered in the literature review.

Hypothesis one proposes that trust of government and trust of internet will positively affect attitudes toward voting technology acceptance as suggested in the research of Carter and Bélanger (2005).

Building off of the work of Choi and Kim (2012), hypothesis two proposes that a need for accessible voting devices will positively affect a voter's preference for voting technologies; and hypothesis three submits that voters expect their ballot to be accurate, confidential, and secure when using voting technologies.

Hypothesis four leans on research conducted on user trust and security in e-commerce and online banking (Bélanger, Hiller, & Smith, 2002), (Lim, 2003). It proposes that voters who show concern of internet security will show lower acceptability of voting technologies.

In accordance with the research of Anthony et al. (2000), hypothesis five suggests that participants who rank high for openness on the Ten Item Personality Inventory will show greater acceptability of voting technologies.

Irani showed that use of Internet-based communications technology is higher among users with previous experience (2000). In this vein, hypothesis six submits that participants in provinces with more experience with voting technologies will have a greater acceptability of voting technologies.

Jang's research (2014/2015) states that convenience influences adoption of technologies. Hypothesis seven proposes that voters who find voting inconvenient will show greater acceptability of voting technologies.

4.3 Material

All recruitment material and consent forms made clear to participants they were allowed to quit the study at any time during, and up to one day after, their participation.

4.3.1 Limesurvey

The online questionnaire was developed and hosted on Limesurvey. Limesurvey is an open source online survey tool. It is written in PHP. The platform is downloadable and hosted on Carleton servers, which ensures that all the data is secure and accessed by as few people as possible.

Table 1. List of all voting technology-related questions included in the Limesurvey questionnaire. Responses were measured on a 7-point Likert scale from "strongly disagree" to "strongly agree".

Trust
T1. I believe that the Internet is a secure environment for voting.*
T2. I would be uncomfortable providing personal information to a third-party company hired by the government to conduct an election.**

T3. I believe any technology set up by the government to conduct an election would be secure.

CIA
CIA1. I believe that an electronic voting system will prevent tracing ballots to specific voters.*
CIA2. I believe that an electronic voting system will prevent others from seeing whom I vote for.*
CIA3. I feel assured that legal and technological structures adequately protect voting processes from malicious forces on the internet.**
CIA4. Alternative methods of voting are irrelevant if they are not available during the entire duration of the voting period.

Accuracy
ACC1. I believe that the technical structures of an electronic voting system will prevent modification of my vote.*
ACC2. I don't believe an electronic voting system will ensure my vote is recorded accurately.*
ACC3. I believe that an electronic voting system will reduce the occurrence of ballot counting errors.*

Convenience
CON1. My voting habits would not change if there were more methods of voting available to me.
CON2. I have skipped voting in the past because it has been inconvenient for me.

Usefulness
U1. I think that I would find an electronic voting system useful.*
U2. I would be more likely to vote if there were more methods of voting available to me.
U3. Voting online would enable me to vote more quickly.**

Accessibility
ABILITY1. I have no difficulty voting with pencil and paper at a polling station.

ABILITY2. Accessing my local polling station is difficult for me (due to distance, location, stairs, physical challenges, etc.).

ABILITY3. I require the help of another person or assistive device when voting.

Ease of Use
EoU1. Using an alternative voting technology would not make it easier to vote.**
EoU2. Learning a new way to vote would be challenging for me.
EoU3. I believe interacting with a new voting technology would be a clear and understandable process.**

* (Choi & Kim, 2012)
** (Carter & Bélanger, 2005)
All questions not otherwise cited were created by me for the purpose of this study.

4.4 Procedure

4.4.3 In-person Questionnaire and Interview

For the 17 participants who took part in the study in-person, they completed the survey online and then completed the interview in person or on the phone. When completed in-person, the participants would complete the questionnaire online and then the interview was completed in the library study room at the Southern Alberta Institute of Technology, or in a private office space. Participants who opted to conduct their interviews over the phone did so either by audio or video Facetime, or by a phone call.

The entire questionnaire and interview process took roughly 30 minutes. This allowed enough time for the participants to complete the questionnaire online and then reflect back on their comments for the interview. The interview was semi-structured. It comprised of seven basic questions, which were included to receive feedback directly from voting Canadians about their understanding of voting technologies, their previous voting experiences, and situations in which they might find voting technologies to be beneficial. The questions are listed as IQ for "Interview Questions". The questions were:

IQ1. What would make the voting process easier for you?

IQ2. Under what circumstances would you feel comfortable using a voting technology?

IQ3. How should organizations prevent data breaches?

IQ4. Which method(s) of voting do you believe would most accurately convey the intent of the voter?

IQ5. What challenges have you encountered at a polling station when going to vote?

IQ6. In what way might the inclusion of voting technologies be useful to you during an election period?

IQ7. In the past, how has convenience impacted your ability to vote?

Follow up questions were included based on the participants' responses. Interviews were recorded on a passcode-protected audio-recording device and then transcribed.

Chapter 5: Results

5.1 Quantitative Results

5.1.2 Participants

A total of 124 participants completed the online questionnaire. Of these participants, all were Canadian citizens. Six participants were omitted for not meeting the eligibility criteria: two participants lived and voted in the USA, one in India, two participants did not specify a city in which they vote, and one participant stated they were not of legal voting age. This left a total of 118 participants

Of the 118 participants, there were 43 female and 75 male participants. The average age of the participants was young, with 81% under the age of 44, and 37% between the ages of 25-34.

The level of education amongst participants varied widely. Nearly as many participants had a bachelor's degree or more (51%-- master's degree, professional degree, doctorate degree) as had a college diploma or less (49%-- trade/technical/vocational training, high school graduate or equivalent, did not complete high school).

As part of the demographic information collected from participants, each participant was asked to name the city in which they live and vote. From here, the cities were coded by province. A total of 9 provinces were represented by participants, with the only province missing being Prince Edward Island. There were no participants from the Territories. As expected, the greatest number of participants claimed to live and vote in Ontario (53%), with the second most represented province being Quebec (16%). The remaining participants reported voting in British Columbia (12%), Alberta (12%), Nova Scotia (3%), Manitoba (2%), Saskatchewan, New Brunswick, and Newfoundland (2.5%).

Participants' reported household incomes were diverse but normally distributed. The greatest number of participants (27%) reported an annual household income of $45,000-$69,999, with 19% reporting incomes of $20,000-$44,999 and $70,000-$99,999 each. 8% of participants reported income of less than $20,000, while 27% of participants reported household incomes of greater than $100,000. Only 2 participants reported $200,000 or more.

5.1.3 Methods of Analysis

To analyze the data, the first step was to run descriptives to gain a better understanding of the data. From here, I began creating histograms to see the distributions of the data in certain questions, particularly for the Acceptability factor using questions CON1R, U2 and EoU3 (fig. 16), the SeBIS factor (fig. 17), and the Convenience factor (fig. 18). Then scatterplots were created to see the relationships between variables.

Means were used for the composite factors. The data was analyzed using Spearman's rho to determine correlations between the data and to answer the hypotheses. This is due to the data representing ordinal scales and Spearman's rho represents a more conservative approach.

Table 2 depicts the questions used for each factor.

Factor	Questions
Accuracy	Mean of ACC1, ACC2R (reverse coded), ACC3
Acceptability	Mean of CON1R, U2, EoU3
CIA Mean	Mean of CIA1-CIA4
Convenience	Mean of CON1R-CON2
Openness	Mean of Q5, Q10R
Preference	Mean of U1-U2, EoU1R
Province	Participant's voting city coded by province
SeBIS Mean	Mean of Q11-14, Q16-Q17, Q22, Q24-Q26 Q15R, Q18R-Q21R, Q23R
Trust	Mean of T1, T2R, T3
Trust of Government	T3

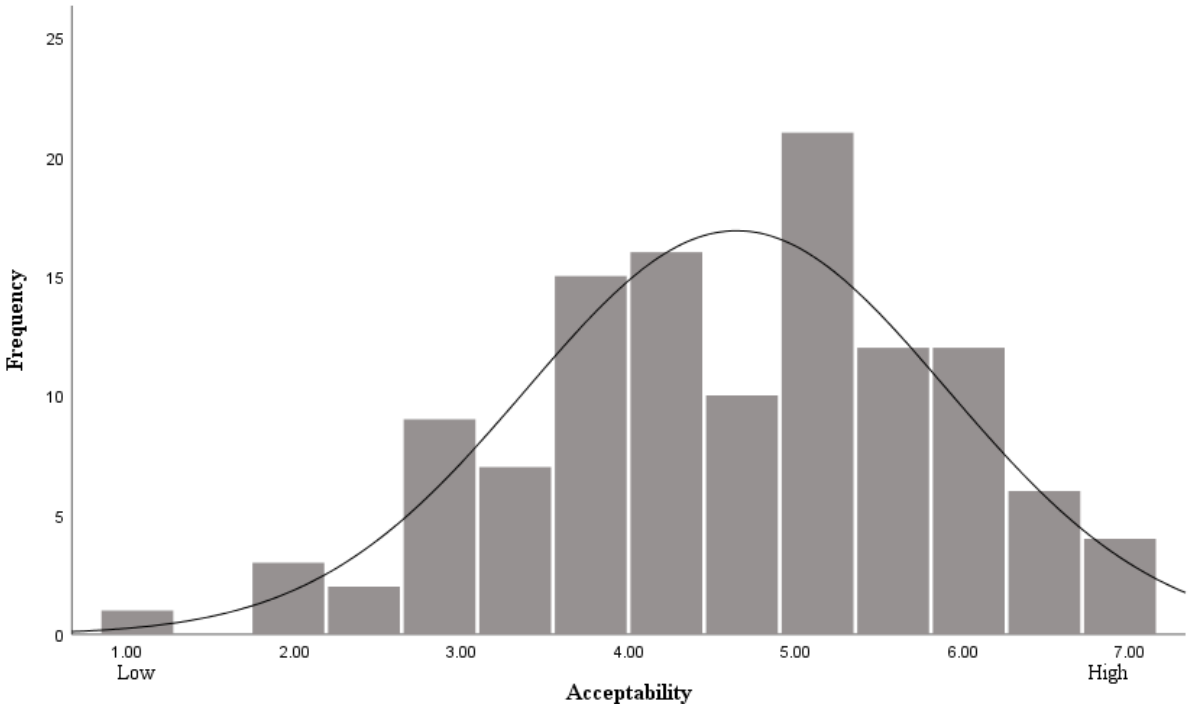

Figure 16 shows the distribution of Acceptability scores for participants with a normal distribution curve. The data was measured with a 7-point Likert scale, with 1 showing low acceptability (answering strongly disagree to the questions), and 7 showing high acceptability (answering strongly agree to the questions). Acceptability is a major factor used to determine how accepting participants are of voting technologies.

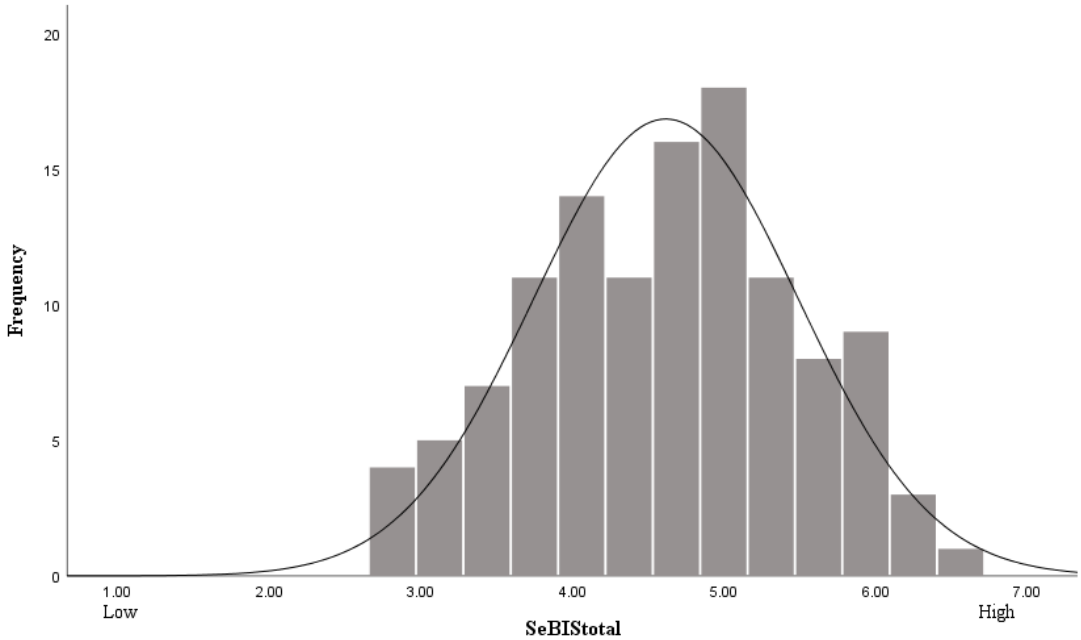

Figure 17 shows that the distribution of the SeBIS scores is approximately symmetric. A normal distribution curve was included to further illustrate this point. This shows there is a wide range in individuals' understanding of, and adoption of precautionary measures towards cybersecurity.

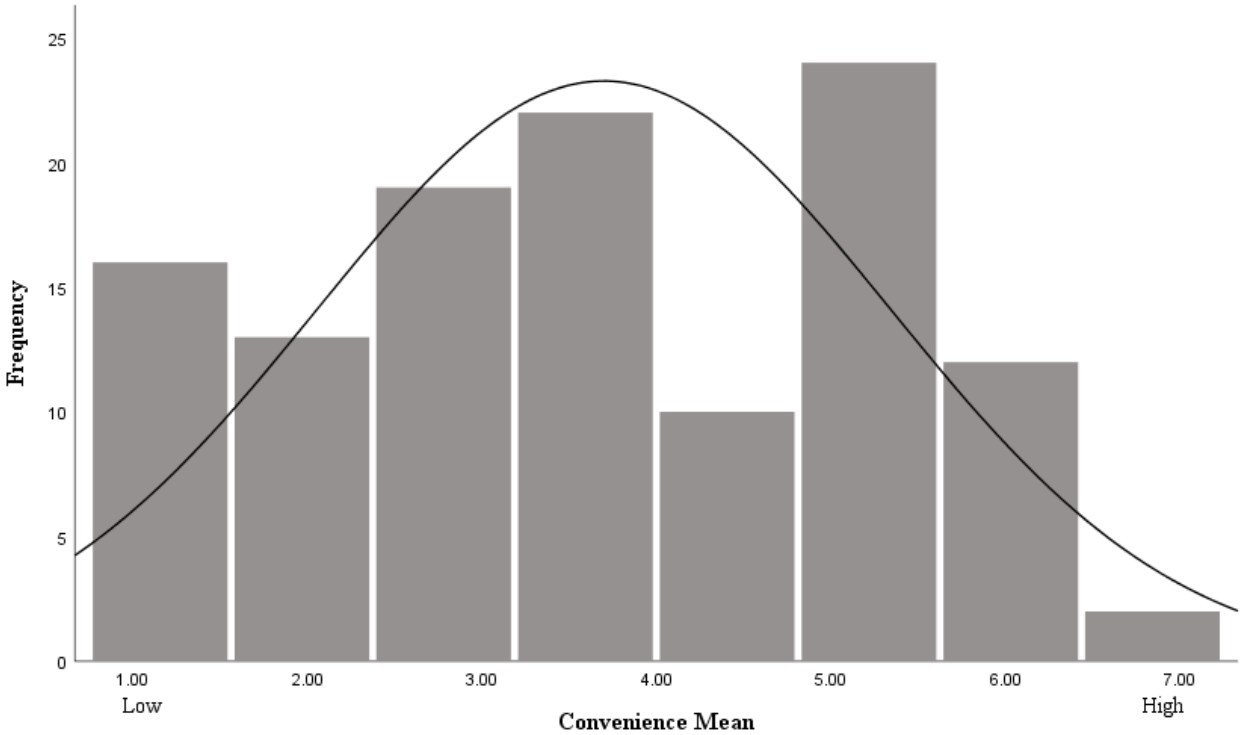

Figure 18 shows that the distribution of the Convenience scores is approximately symmetric, and platykurtic. This shows that some participants find voting as inconvenient as others find it convenient.

H1: Trust of government and trust of internet will positively affect attitudes toward voting technology acceptance.

Table 3 displays the correlation between Acceptability and Trust.

		Trust Mean
Acceptability	Correlation Coefficient	.430
	Sig (2-tailed)	<.001

A moderate and significant positive correlation was found between Trust and Acceptability with $r_s = .430$, $p < .001$. This shows support for H1, therefore rejecting the null hypothesis, and that participants who claim to trust the internet and their government show greater acceptability of voting technologies.

H2: A need for accessible voting devices will positively affect a voter's preference for voting technologies.

Table 4 displays the correlation of Accessibility and Preference.

		Accessibility Mean
Preference	Correlation Coefficient	.235
	Sig (2-tailed)	.010

A weak but significant positive correlation was found between Accessibility and Preference, r_s = .235, p = .01. This shows that the null hypothesis was rejected, and H2 was supported since those with accessibility needs show a preference for voting technologies.

H3: Voters expect their ballot to be accurate, confidential, and secure when using voting technologies.

Table 5 displays the correlation of Trust of Government, Accuracy, and Security (CIA).

		Trust of Government	Accuracy Mean	CIA Mean
Trust of Government	Correlation Coefficient		.611	.558
	Sig (2-tailed)		<.001	<.001
Accuracy	Correlation Coefficient	.611		.543
	Sig (2-tailed)	<.001		<.001
CIA Average	Correlation Coefficient	.558	.543	
	Sig (2-tailed)	<.001	<.001	

Each of these correlations were found to be significant with strong positive correlations. Trust of Government and Accuracy $r_s = .611$, $p < .001$, Trust of Government and CIA Average $r_s = .558$, $p < .001$, and Accuracy and CIA Average $r_s = .543$, $p < .001$. Therefore, the null hypothesis was rejected and H3 is supported in that voters always expect their ballot to be accurate, confidential, and secure.

H4: voters who show concern for internet security will show lower acceptability of voting technologies.

Table 6 depicts the correlation between participants' overall SeBIS scores and Acceptability.

		SeBIS Mean
Acceptability	Correlation Coefficient	.185
	Sig (2-tailed)	.045

There was a weak positive correlation found between Acceptability and SeBIS scores $r_s = .185$, $p < .05$. This shows the null hypothesis was not rejected and that H4 was not supported since participants who show concern for internet security practices show greater acceptability of voting technologies, as seen in fig. 19.

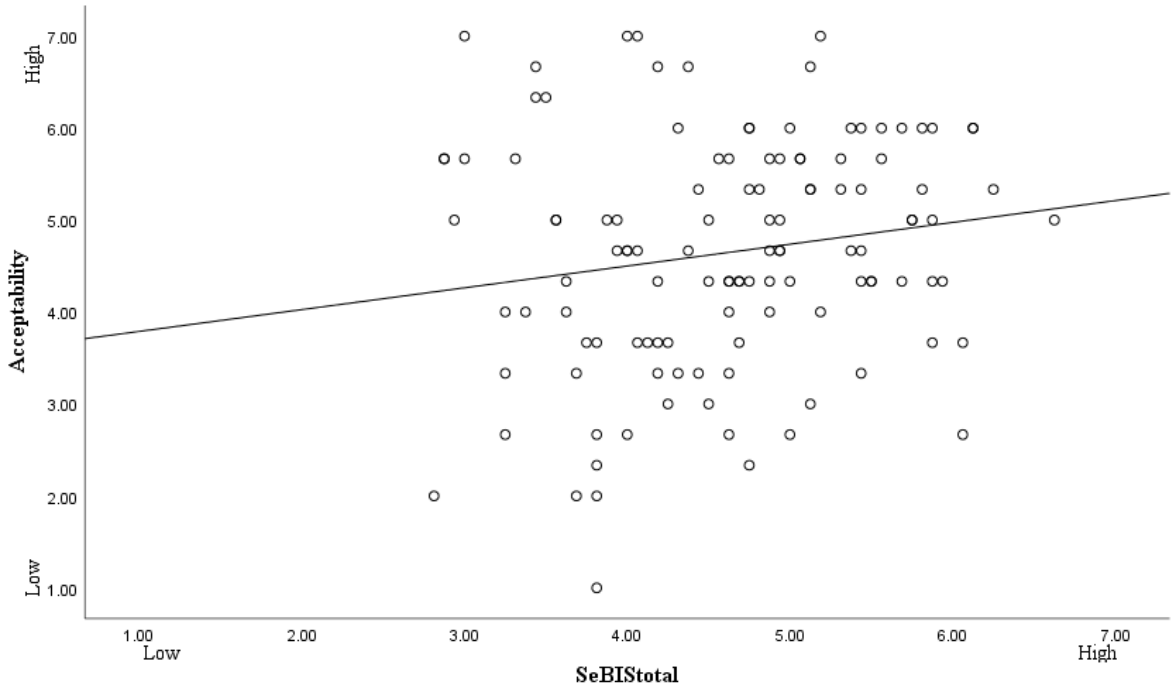

Figure 19 shows that participants who score higher on SeBIS actually show greater acceptability of voting technologies.

H5: Participants who rank high for openness on the Ten Item Personality Inventory will show greater acceptability of voting technologies.

Table 7 shows the correlation between Acceptability and Openness.

		Openness
Acceptability	Correlation Coefficient	.159
	Sig (2-tailed)	.085

A weak correlation which was not statistically significant was found between Acceptability and Openness $r_s = .159$, $p = .085$. This shows the null hypothesis was supported and therefore H5 was not supported as there is no relationship between a participant's Openness, as determined by the TIPI, and their acceptability of voting technologies.

H6: Participants in provinces with more experience with voting technologies will show greater acceptability of voting technologies.

Table 8 shows the ANOVA completed using Acceptability and Province.

	df	*SS*	*MS*	*F*	*Sig.*
Between Groups	8	15.912	1.989	1.276	.264
Within Groups	109	169.930	1.559		
Total	117	185.843			

I did not ask participants specifically if they had previously used any voting technologies, so analysis based on experience was determined by location. No significant effect was found for Acceptability based on province F(8, 109) = 1.276, p = .264, n^2_p = .086. This result was further made clear by comparing Ontario and Quebec, the two provinces with the greatest number of participants in the study (fig. 20). Ontario has included technology in municipal elections for over a decade in many communities, whereas Quebec has a moratorium on all forms of technology in elections. The two provinces showed comparable scores for Acceptability. Equal variances assumed through Levene's test p = .264. Therefore, the null hypothesis was supported for H6.

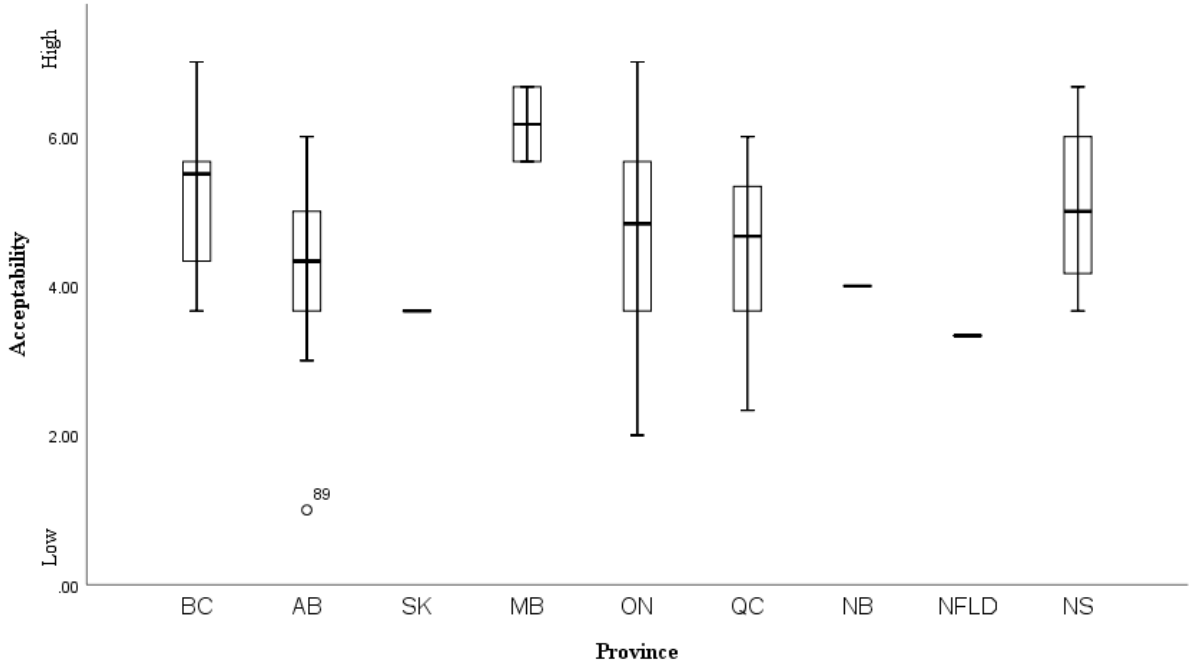

Figure 20 compares the Acceptability scores across all provinces of participants. Acceptability scores are comparable across all provinces, but with a wider range in Ontario due to 53% of participants living there.

H7: Voters who find voting inconvenient will show greater acceptability of voting technologies.

Table 9 displays a correlation table showing Acceptability and Convenience.

		Convenience Mean
Acceptability	Correlation Coefficient	.743
	Sig (2-tailed)	<.001

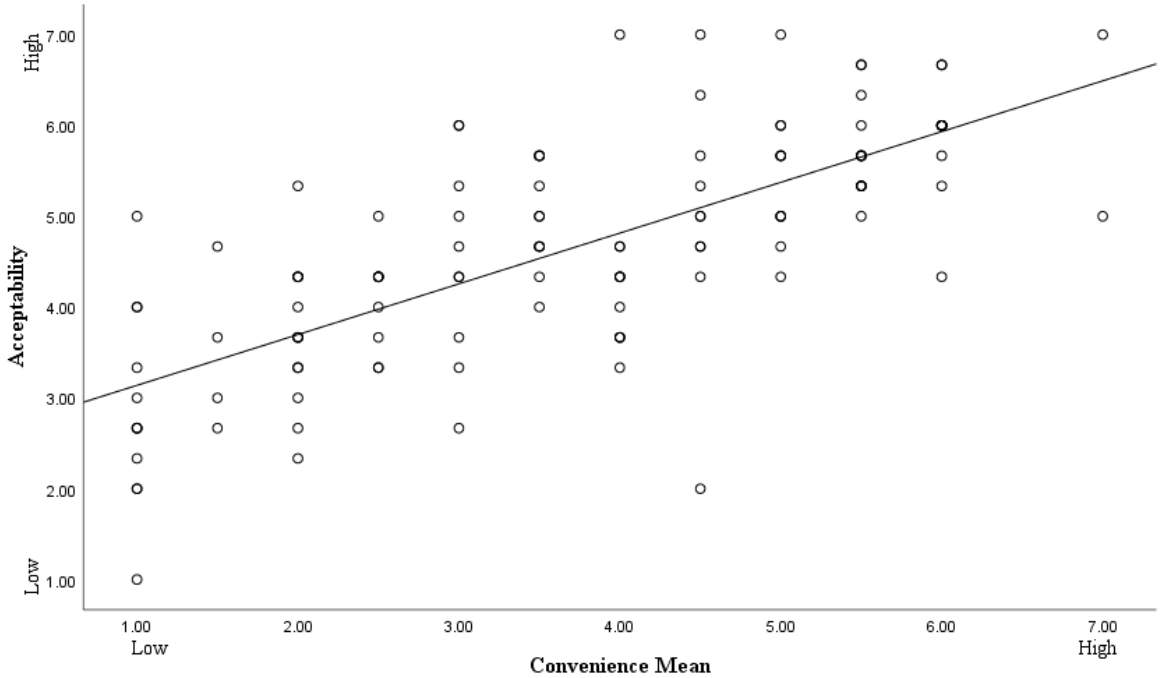

Figure 21 shows the strong, significant positive correlation between Acceptability and Convenience.

A strong, statistically significant, positive correlation was found between Acceptability and Convenience, $r_s = .743$ $p < .001$. This shows that the null hypothesis was not supported for H7 and therefore participants for whom convenience plays a role in their voting show greater acceptability of voting technologies.

5.2 Qualitative Results

5.2.1 Participants

Participants for the interviews were recruited primarily through word of mouth. Interviews took place in person and on the phone, depending on what was easiest for the participant. A total of 17 participants took part in the interviews. Six participants were female, and 11 were male. Of the 17, 10 participants were aged 25-34, while four were 18-24 and three were 45 or older.

Participants' experiences in education were more diverse, with one participant who was a high school graduate, four with trade or vocational training, three with college diplomas, six with bachelor's degrees, two with master's degrees, and one participant with a professional degree.

Average household income was also diverse. Two participants listed their average household income at less than $20,000. Just over 50% of participants listed their average household income as less than $70,000 while less than 30% of participants were between $70,000-$200,000. Only one participant claimed an average household income of $200,000 or more annually.

These participants came from Ontario and Alberta and are living and voting in either Ottawa (11 participants), Calgary (four participants), or Cold Lake (two participants). The majority of the participants were urban or suburban-dwelling and as such, their experiences may not be representative of all Canadians.

5.2.2 Thematic Analysis

Thematic analysis was undertaken to analyze the results of the interviews with 17 participants. The guidelines outlined by Braun and Clarke were followed (Braun & Clarke, 2006).

Initial coding of the interview results was conducted to determine direct responses to the questions asked. The open-endedness and slight vagueness of the questions allowed for a greater variety of responses and more careful consideration on behalf of the participants.

Table 10 displays the codes used for qualitative analysis of the interviews along with the total number of times the codes were mentioned, and the number of participants who mentioned them.

		Total Mentions	Number of participants who mentioned
1	Disabilities	12	7
2	Age	7	6
3	Security	26	13
4	Political engagement	8	4
5	Backup to paper	8	4
6	Trust tech	6	6
7	Trust government	8	7
8	Inconvenience	10	5
9	Convenience	14	8
10	Travel	16	9
11	Testing	8	5
12	Government	4	3
13	Error	1	1
14	Verification	6	4
15	Frustration	0	0
16	Confusion	8	5
17	Unknown/ lack of knowledge	18	10
18	Easy	17	10
19	Privilege	1	1
20	Excitement	3	3
21	Not voting	4	4
22	Vote in advance	17	10
23	Student	10	4
24	Election day	4	3
25	Cyber security	2	2
26	Integrity	3	2
27	Concern	5	4
28	Privacy	5	5

Total Mentions		Number of participants who mentioned	
29	Mailed ballot	9	4
30	Stress	2	2
31	Time	4	3
32	Work	10	6
33	Accessible	8	6
34	Slow	2	1
35	Faster	4	4
36	Lines	8	6
37	Busy	5	3
38	No problems	15	8
39	Happy	3	3
40	Familiar	1	1
41	Waiting	1	1
42	Reliable	1	1
43	Political interference	12	5
44	Human error	6	6
45	Risk	2	2
46	Home	4	3
47	Hack	5	2
48	Weather	2	2
49	Voter registry	2	2
50	Increase turnout	1	1
51	Worry	1	1
52	Vote anywhere	4	3
53	Lazy	4	3
54	Not comfortable	4	4
55	Companies	4	4
56	Trust of companies	2	2
57	Anonymity	2	2

Total Mentions		Number of participants who mentioned	
58	Difficult	1	1
59	Transparency	2	2
60	Dread	1	1
61	Comfortable	2	2

IQ1 What would make the voting process easier for you?

This was the first question participants received. Six participants felt voting online would make the voting process easier for them:

> "If there were more opportunities to vote ahead of time, online for example." (P2)

> "Voting online because I don't need to go outside, I would just turn on my laptop." (P4)

> "It's pretty easy so far but having the availability to do it online would make it easier to not have to take time off work to go vote." (P8)

From the participants who stated online voting would make voting easier for them, convenience appears to be a theme. By removing some of the work involved in voting, including leaving the house and taking time off work, or just by giving voters more options that may fit their schedule more easily, voters may find it easier to vote.

Four participants said that voting in Canada is not currently a difficult process and nothing could make the process easier for them:

> "Nothing. I don't have any difficulties with the current voting system." (P5)

> "I'm not sure if anything would make it easier, I think it's fine right now." (P6)

> "I'm not someone who finds the voting process difficult." (P9)

> "I don't think that it's hard. I don't think anything needs to be done to make it easier for me. I don't find it hard at all." (P13)

IQ2 Under what circumstances would you feel comfortable using a voting technology?

Eight participants said they would feel comfortable using a voting technology which they felt was adequately vetted, tested, and secure:

> "I think if it was properly vetted and I knew exactly what had been done to make it secure, I generally am pretty trusting of technology." (P1)

> "Ideally in a well-tested, well-vetted proven technology. I don't know if that exists but that would be the ideal." (P8)

> "I think I would have to be entirely trusting that it couldn't be manipulated by external forces. Be they internal to the country or external." (P10)

This showed that participants who were interested in exploring voting technologies still wanted the technology to be secure. Trust of technology is also mentioned here, seemingly related to an understanding of how the technology works. Some of the other responses which were offered were considerate of potential events or consideration of others' circumstances:

> "In [case] of inclement weather, or if I became physically disabled," (P5)

and living outside of your home riding (P2). This more abstract thinking suggests the respondents are not solely thinking of their own needs and experiences while voting but also the potential of more challenging circumstances in future which may inhibit them from accessing polling stations.

IQ3 How should organizations prevent data breaches?

This question quickly illustrated how little the general population knows about computer security. 10 participants said they had no idea how organizations should prevent data breaches. Responses varied from:

> "I don't have enough background in security" (P3), to

> "I know nothing" (P5),

> "Not my specialty" (P8), and
>
> "I don't know" (P15)

The lack of technological knowledge of the majority of the participants allowed them to be creative in some of their responses. After acknowledging their ignorance, some participants continued by mentioning security concepts they were familiar with. Three participants suggested encryption, with P1 suggesting encryption based around the concept of a double-blind study. Other recommendations included non-disclosure agreements, employee training, firewalls, or 2-Factor Authentication (2FA). One idea which was mentioned was hiring third party cybersecurity firms:

> "I suppose hiring cybersecurity companies to deal with that would be reassuring, knowing that it's not all done in-house is encouraging to me at least." (P10)

Or not involving a third party and having all data in-house:

> "It should not be an off-site third-party company holding the data. Elections Canada should have their own building where all the data is stored." (P7)

While security was the topic of conversation for this question, the major theme was a lack of knowledge. The majority of participants made it clear they had no knowledge on the subject while others hypothesized about possible security solutions, some more feasible than others.

IQ4 Which method(s) of voting do you believe would most accurately convey the intent of the voter?

This question resulted in the least variation of responses. The intent behind the question was to ascertain which methods of voting participants think would result in the fewest errors and would result in the most accurately counted ballots.

Eight participants cited the manual paper ballot voting system which is currently employed by Elections Canada for federal elections and is the default method of voting across the country, with participants saying:

> "I suppose the [ballot] is pretty easy to fill out if I remember correctly." (P8)

> "Maybe if you can't figure out a ballot sheet you shouldn't be voting." (P16)

Becoming clearer is that for the most part, participants do not find the current voting system to be a struggle or challenging. It is easy and straightforward.

After paper ballots, five participants stated online voting three suggested electronic voting of some sort, and one suggested touch screen voting machines. The participants who said online voting also offered design recommendations. The reoccurring concept was the need for verification in an online system. Recommendations included having the system confirm your vote with messages such as:

> "Are you sure you want to select this candidate?" (P3) and,

> "Once you submit you are committed to this candidate" (P7).

This suggests that voters expect to see feedback from their voting machines to confirm their actions, just as many websites for online banking will do. The number of participants who suggested methods of voting other than paper ballots shows there is an openness to new methods of voting and the possibilities for accessibility:

> "I don't think pencil and paper will necessarily work super well especially with people with learning disabilities like dyslexia. Voting stations where you're in a room where you can use maybe [headphones and a microphone] to cast your vote or have it read the options to you. One where you have more options available to you." (P14)

This highlights the need for voting to be easy and accessible for all voters.

IQ5 What challenges have you encountered at a polling station when going to vote?

More participants suggested they had previously had issues when going to vote than those who did not. The most common problem was waiting and lines, with a typical wait time

being 10 minutes, but some participants had experienced much longer times at their polling station:

> "Once for half an hour, which for me is a long time." (P5)

For some, lines are an annoyance, while for others they can become an issue of convenience, or even an accessibility issue.

Other participants initially struggled with how to vote once they turned 18, saying there were no clear instructions for voting:

> "No one told me how to vote, no one told me what was happening, so I was kind of lost the whole time." (P1).

> "Obviously now I know how to vote, but the first few times… sometimes you get confused." (P14)

Again, lack of knowledge makes an appearance. Voting is a highly individual activity which can make it difficult to seek help if you have questions. If a voter is unsure of what to do when they go behind the voting screen, they are alone.

Four participants noted difficulty in accessing polling stations. P1 had to take multiple busses to access their polling station. P15 was reliant on transportation from others to access a polling station. P16 and P17 found there were too few advanced polling days. These issues relate back to convenience and accessibility with a focus on travel. When it is harder for people to vote, or to get to their polling stations, they are less likely to do so.

IQ6 In what way might the inclusion of voting technologies be useful to you during an election period?

The highest number of respondents expressed a desire for the ability to vote anywhere. Some participants would like the ability to vote from home:

> "So you can vote from the sanctity of your own couch!" (P5),

While out of the country or travelling:

> "If I was away outside the country and couldn't make it to vote or didn't have time to get the paper sent in to vote." (P7)

> "If I'm away then I can just do online voting like a survey kind of thing. That would probably be good." (P12)

Voting from an area closer to work was considered to be useful as well:

> "Vote from work, vote from everywhere would be pretty awesome." (P16)

Each of these statements related back to convenience and accessibility. The current voting system for Canadian federal elections, as well as most provincial elections, only allows you to vote at your assigned polling station if you are voting on election day. This can be limiting to many voters. These limitations, as seen through convenience and accessibility, are felt through these statements.

IQ7 In the past, how has convenience impacted your ability to vote?

Some participants altered their behaviour in order to vote more conveniently, such as by going to advanced polls:

> "Early voting options are nice. Being on shift work, I can go quite early ahead of time and I don't need to worry about lines or other things. I can pick a day when I'm off and I have time to go and it makes it really simple for me." (P3)

Or voting later in the day:

> "I try to go at night because less people go at night, I think." (P17)

Nine participants said convenience has not impacted their ability to vote. This suggests that while voters would like more convenience and flexibility in their voting methods, many will still vote. Only three participants (P2, P8, P12), said that their work had at times made it too inconvenient to vote and therefore they had missed elections:

> "It wasn't convenient for me, so I couldn't." (P12)

This shows there is a real impact to inconvenience in voting. The theme of convenience has surfaced throughout the interview and ultimately some participants had experienced the inability to participate in democracy due to inconvenience.

5.2.3 Themes

After coding the data further by reoccurring concepts and sentiments, a clearer picture began to emerge about what the participants were most interested in or concerned about, depending on the number of times a concept was mentioned.

The three major themes which emerged were security, convenience, and lack of knowledge.

Security

From the conversations in the interviews, the concept of security was closely tied to lack of knowledge, as they often came up in tandem. Despite this, lack of knowledge cannot entirely be considered a subtheme since there were two distinct stances on the relationship between the two:

> "I don't really understand security breaches or how these things would happen, so I'm not concerned about it because I don't really understand it." (P15) and,
>
> "I just don't know that I would feel perfectly comfortable [using a voting technology] because of my own ignorance." (P16)

IQ2 and IQ3 specifically asked participants about security, but despite this, security had the overall greatest number of mentions in the interviews with a total of 26. Two individual participants referred to security five (P6) and four (P16) times each, showing the greater focus on the topic outside of just the security-specific questions. These participants were very concerned about the security risks of adopting voting technologies due to election interference (P6) and hacking (P16).

Unknown/Lack of Knowledge

"I'm lost here. Tell me what to do" (P1). Overall, there was a lot of mention of not knowing or a lack of understanding. Predominantly this theme appeared in IQ3 and IQ5. This theme applied to voting at a polling station (P1, P14), electronic and data security (P3, P5, P6,

P8, P9, P11, P12, P13, P15, P16) and also appeared when asked about challenges faced at polling stations (P1, P2, P6, P14).

Convenience

Ease, Travel, and Vote in Advance are subthemes of Convenience as their references were related to making the voting process less cumbersome.

Ease

The idea of voting either being easy, should be easy, or could be easier was prevalent. Overall, participants do not find the current voting process difficult. Seven participants outright said that the current voting process is easy (P1, P6, P8, P10, P13, P16).

When asked about how voting technologies might be useful to them during an election period, four participants said voting technology would make the voting process easier (P1, P4, P6, P18).

Travel

Travel was brought up in a number of different ways. Travel was used as a code to signify getting to a polling station using a method of transportation, but also when participants said that having more methods of voting available to them would be beneficial if they were on a trip. P1 and P15 had previously experienced difficulties trying to reach their polling station on Election Day while P1, P2, P6, P7, P8, P12, P14, P15, and P17 had expressed concern about missing elections because of travel.

Vote in Advance

A total of 10 participants made reference to voting in advance. This included three participants who had previously voted by mail because they were living outside of their home ridings (P2, P6) or who were traveling for election day (P17). Six participants had used the advanced voting days previously (P2, P3, P5, P7, P10, P14). P12, P16, and P17 expressed a desire for more advanced voting days. This shows that more than 50% of participants are aware

of methods of voting other than solely on election day and 47% had utilized one of the alternative methods of voting.

This shows that voters are interested in and receptive to voting alternatives which are more convenient to them.

5.2.3 Unifying Thematic Theory

This theory shows the relationships between the three themes which were discovered through the interview portion of the study (fig. 22). It was clear there was a relationship between Security and Lack of knowledge since there was a lot of tension between the two concepts. The overlapped section of the Venn Diagram illustrates the lack of knowledge of security systems which some participants displayed. Having the label "Caution" above this section of the model shows the feeling of uncertainty from voters about using voting technologies before considering Convenience, which leads to more appeal in the use of voting technologies.

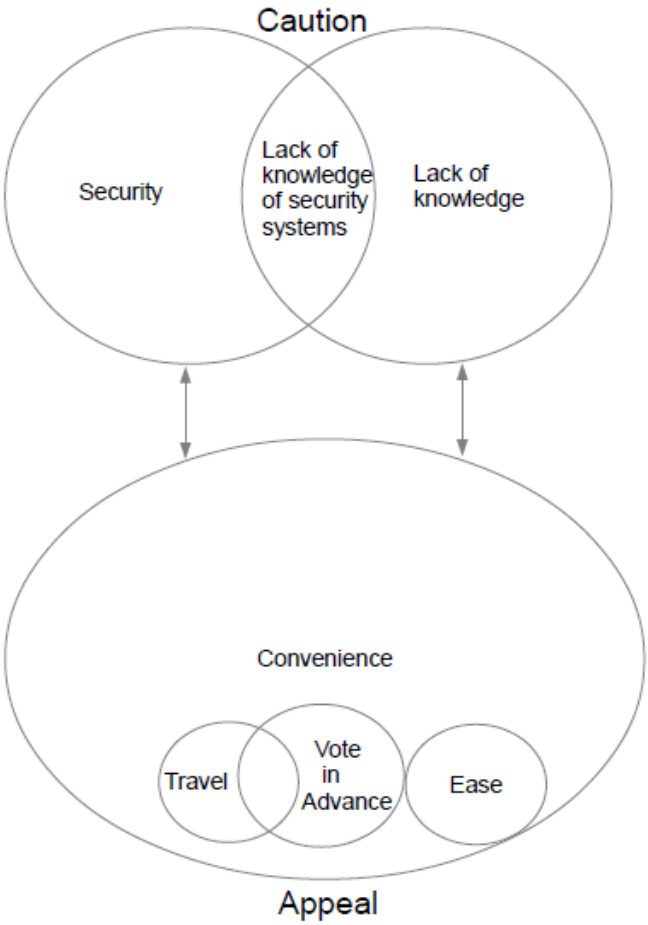

Figure 22 illustrates the thematic theory unveiled through the qualitative interview portion of the study.

It is clear that participants want convenience in their voting process. This can be regarding travel, advanced polling options, or just making the entire process easier. Travel and Vote in Advance overlap as they share the desire to vote at a different time or place. Voters do not want to worry that their vacation plans, business trip, or just their address will negatively impact their ability to vote on election day. By minimizing the effect of travel through easy access to early voting, participants may vote more reliably.

The double-ended arrows in the model show the tension between the desire for convenience and the lack of knowledge and security concerns participants showed.

But whether participants felt comforted or threatened by their lack of knowledge, were concerned about security or were open to new methods of voting, convenience was a theme which was mentioned in some way by all but one participant.

5.3 Results as Relate to Model

While answering the hypotheses cemented the links made in the model from Chapter 3, further analysis was used to confirm or refute the remaining relationships drawn in the model.

The relationship between Accessibility and Perceived Ease of Use was found to not be significant, $r_s = -.067$, $p = .474$. This means that Accessibility should not be shown as connected to Perceived Ease of Use, but rather since it showed a weak correlation with Acceptability, $r_s = .267$, $p = .004$, Accessibility could be connected directly to Technology Acceptance.

Participants for whom convenience plays a role in their voting see greater perceived usefulness in voting technologies, $r_s = .421$, $p < .001$. This validates the presence of Convenience in the model and its relationship with Perceived Usefulness.

Perceived Usefulness and Accuracy showed a significant, moderate, positive correlation, $r_s = .444$, $p < .001$. This validates the presence of Accuracy in the model and its relationship with Perceived Usefulness.

As seen in H3, CIA and Trust showed a significant, moderate, positive correlation, $r_s = .558$, $p < .001$. This validates the presence of these variables in the model and through H1, confirm the relationship of Trust with Technology Acceptance through the variable of Acceptability.

Therefore, all relationships illustrated in the model were validated save for Accessibility and Perceived Ease of Use, but Accessibility could be linked directly to Technology Acceptance.

Chapter 6: Discussion

The research questions posed in advance of this study were:

RQ1: What attitudes and concerns do Canadians have about voting technologies?

RQ2: What factors drive Canadians to accept a voting technology?

RQ3: What are major barriers to acceptance for voting technologies?

6.1 RQ1: What attitudes and concerns do Canadians have about voting technologies?

In response to RQ1, it has been made clear through the interviews and analysis that some Canadians are concerned about the adoption of voting technologies in Canadian elections due to the security risks, while others are interested and think it would be beneficial for voters with accessibility needs and to help make voting more convenient.

Most participants appeared to take security reasonably seriously when they initially took the online questionnaire. The SeBIS scores were normally distributed with a mean score of 4.6 and when correlated with Acceptability in H4, it was determined that participants who show concern for internet security practices show greater acceptability of voting technologies. While this was the result found in the questionnaire, the result did not fully translate to the interviews.

Amongst interview participants, there was a strong awareness of the importance of security. Security is a legitimate concern and is the primary reason why more voting technologies have not been implemented across Canada. For some participants this concern has made them steadfast in their pro-paper ballot stance, while for others it has made them more interested in using voting technologies since they trust their government and the technology to be secure.

While the majority of Canadian voters do not require accessibility devices or the assistance of another person to mark their ballot, and most Canadians' home address is within walking distance of their local polling station, many voters could still benefit from more convenience and accessibility in the voting system. Interview participants expressed interest in the ability of online voting to resolve these issues. The Convenience scores determined through the online questionnaire showed a wide spread of experiences in convenience when voting. The data was platykurtic which indicated many participants had had convenient voting experiences, and many had inconvenient voting experiences.

More than a third of interview participants stated that voting online would make the voting process easier for them. Five participants had missed elections for reasons other than apathy, primarily living outside of their electoral district either as students or in military postings which made voting difficult.

6.2 RQ2: What factors drive Canadians to accept a voting technology?

For RQ2, voters find voting itself to be easy: it's the simple mark of an X on a ballot. What is less easy is finding transportation to your polling station, trying to find a way to vote when spontaneous and conflicting travel arises, and not having the time or energy to stand in line for half an hour when you have been working shift work.

Through the quantitative analysis as seen in H1, H4, and H7: trust of government, trust of internet, strong internet security practices, and inconvenience contribute to acceptability of voting technologies. Each of these factors showed statistically significant correlation with acceptability.

From the interviews the clearest answer is inconvenience. Voters who have experienced inconvenience are more drawn to alternative methods of voting and voting technologies. There must be a need. P2, P6, and P17 have all used advanced polls or have voted by mail and 2/3 indicated an interest in voting technology. P8, P12, and P14 have missed voting in elections due to work conflicts and indicated an interest in having more methods of voting available to them to mitigate this problem. P5 has accessibility issues, P7 travels, and P3 works shift work; each of these participants has used advanced polls to diminish the inconvenience of election day. Each of these participants has been affected by the inconvenience of voting. Alternative methods of voting have allowed some of these participants to cast a ballot, but others have still been unable to due to inconvenient circumstances. Voting itself is not difficult but finding extra time to schedule an irregular event can be. Not all voters are aware of advanced polls. Even fewer are aware of the possibility of voting at their local Elections Canada office in the days leading up to the election.

As seen in both the quantitative results and the qualitative results, convenience is an important part of voting. While most participants said that they care about convenience, but it had not stopped them from voting, five participants said that it had. As seen in the unifying

thematic theory, ease, travel, and voting in advance are all key aspects of convenience which can impact a voter's ability to cast a ballot.

6.3 RQ3: What are major barriers to acceptance for voting technologies?

Finally, for RQ3 the major barriers to acceptance of voting technologies appear to be security concerns, lack of knowledge, and lack of trust.

The quantitative results showed a relationship between strong security practices and acceptability, but the qualitative analysis showed a strong subset of participants to be strongly opposed to voting technologies due to security concerns.

Since Trust was found to have a significant positive correlation with Acceptability, a lack of trust would make it less likely that a participant would be accepting of voting technologies.

The questionnaire and interview participants are not alone in their concerns of security risks; these concerns are echoed by Elections Canada, which is why no voting technologies have been implemented on a national scale. Interview participants with significant security concerns wanted to be entirely sure of the security of a system before using it but also admit they know little about security. They must be convinced the technology is secure but have a limited understanding of security and show minimal trust in the systems which would implement the technologies:

> "Having someone tell me that it's been done properly isn't enough for me to say 'yes thank you' especially when it's done by the government. If I knew somebody who was a computer whiz and they explained it to me and they told me it was worth looking into then I'd consider it, but it wouldn't be a government official that would be telling me this is safe." (P16)

This lack of trust is not solely aimed at the agencies implementing these technologies, but also at the companies who own the voting technologies (P9). Together these concerns create a firm barrier against the acceptance of voting technologies.

6.4 Security

In H4 it was expected that participants who showed concern for internet security practices would show lower acceptability of voting technologies as they would be cautious in

their approach towards security. From the results of the analysis in H4, the opposite proved to be the case: that acceptability increased with SeBIS scores. This could well be accurate, as most interview participants were aware of security risks, but some simply cared more than others. Although the trend in the survey was for people concerned about security to accept voting technologies, in the interviews there was some dissent. 75% of the interview participants who voiced concern for security and an unwillingness to accept voting technologies scored low to average on the SeBIS, which aligns with the outcomes of the survey analysis for H4. These same participants also scored low to average on the Trust questions. This shows that those with low SeBIS scores lack trust in government, technology, and security experts to prevent errors from occurring. In this vein, P13 said:

> "When you think about the data breaches which have occurred with big companies that have the expertise to protect… I question, and I do worry about whether there's a way to truly protect it."

But where is the threshold for security which would ensure voters are comfortable enough to choose to use a voting technology?

> "I would say having confidence that there's security in the process. There's not a chance, well there's always a chance… that I'm comfortable the process is open, transparent, and not subject to the Russians interfering. That's never 100%. [I would be comfortable if] it's convenient and not subject to tampering." (P11)

6.5 Unifying thematic theory and voting technology acceptance model

The unifying thematic model produced in Chapter 5 was comparable to the model developed in Chapter 3 in that they share some of the same factors. From the interviews, security, a lack of knowledge, and convenience were the main themes which resulted. Lack of knowledge is the only one of these themes which is not present in the earlier model. While lack of knowledge was prevalent, it is not a factor which contributes to the acceptability of a voting technology. From this research, assumptions cannot be made about the inclusion of prior knowledge as a factor and any role it may play in the acceptability of voting technologies. The TAM is used as a predictive and explanatory model for new software and technologies users

have not yet encountered, and since this research is based off the TAM, a user's previous knowledge was not focused on in this study.

6.6 Summary

Overall, voters appear to want more methods of voting. They want convenience, accessibility, and more knowledge. Currently, it appears that voters know very little about alternative methods of voting available to them which are intended to increase convenience. Voters want the freedom to not be tied to their home riding on election day.

Chapter 7: Conclusions

In this study, Citizen Understanding of Alternative Voting, the aim was to determine the factors required for voting technologies to be accepted by Canadians.

While Canada has slowly introduced online voting, as well as e-poll books and electronic tabulators in some provinces across the country in municipal elections, as well as e-poll books and tabulators in specific circumstances in some provincial elections, many provinces have hesitated to adopt voting technologies while Elections Canada has thus far completely rejected incorporating technology into federal elections.

By looking at how other countries have implemented voting technologies, such as Estonia's strong and deliberate focus on digital democracy, the United Kingdom's attempt and failure to incorporate telephone voting, and the United States' move towards security standards for DREs, Canada has a number of precedents to look to.

By leaning on the TAM, as well as the work of Choi and Kim and Carter and Bélanger, I constructed a study to measure the current Canadian attitudes towards voting technologies.

The research questions I posed and aimed to answer through this study were:

RQ1: What attitudes and concerns do Canadians have about voting technologies?

RQ2: What factors drive Canadians to accept a voting technology?

RQ3: What are major barriers to acceptance for voting technologies?

To answer RQ1: the data collected through the online survey and the in-person interviews revealed a strong interest on the behalf of Canadians to accept voting technologies to make voting more convenient and accessible. There was also a strong concern for the security of voting technologies due to hacking threats and the politicization of Russian interference.

To answer RQ2: predominantly, inconvenience drives Canadians to accept voting technologies. Participants who had experienced long lines, struggles with transportation to polling stations, or had missed elections due to work or travel showed more interest in the inclusion of voting technologies than those who professed to never having difficulties voting.

To answer RQ3: the barriers to acceptance for voting technology appears to be security concerns and lack of knowledge. Some participants expressed security concerns, while nearly all stated they did not understand security. But this did not stop most participants from showing acceptability of voting technologies. Those who exhibited acceptance of voting technologies also

exhibited widespread trust in government to ensure the security of a voting system. Ultimately, it was determined that while some participants made it clear they had struggled with knowing how to vote when they started out, and most participants explained they did not know how cybersecurity worked, or how one should address data breaches, they were still interested in the benefits which a new voting system could afford them.

7.1 Contributions

The contributions resulting from this work include a model for the factors required in a voting technology to be accepted by citizens, as well as an online survey and in-person interview with quantitative and qualitative analysis applied.

This study also determined the attitudes Canadians hold toward voting technologies and their acceptability.

7.2 Limitations

The main limitations of this work were participants. To gain a broader understanding of the attitudes of Canadians towards voting technologies, a more diverse range of participants could have been interviewed. More participants outside of Ontario and Quebec, or participants who required more assistance in voting may have offered different responses. Many interesting and unexpected experiences and concerns were mentioned during the interviews and a greater number of interviews may have shown more trends or illustrated whether some ideas were more widely held.

7.3 Future Work

Further examination of the role of demographics in this study would be interesting. It was expected that there would be a difference in acceptability between provinces based on provinces which had done more work in implementing voting technology versus ones that had decided not to allow it. This examination in H6 showed no significant results, but further exploration in the area of acceptability based on geography, income, age, profession, and education may show more significant results.

One aspect of voting technology research which should be examined more in depth in future work is the difference in attitudes of voters for different alternative methods of voting. In

this study, a number of technologies were lumped under the umbrella term of voting technologies, but there are different security concerns and usability concerns between telephone voting, DREs, voting tabulators, e-poll books, and online voting and the distinctions should be further studied.

Another relationship worth of further investigation is the role of trust in relation to security. The role of trust became clearer later into the analysis of the results. Although much work has been done in the realm of security and trust (Flavian & Guinalíu , 2006), (Blaze, Feigenbaum, & Lacy, 1996), less work has been completed on this topic in relation to voting technologies. When voters are trusting their government to ensure they have a secure, apolitical environment in which to cast their vote in political-charged elections, the stakes are different, and in ways higher than the situations in which much of the research has been conducted.

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Appendix A: Ethics Clearance

Office of Research Ethics
503 Robertson Hall | 1125 Colonel By Drive
Ottawa, Ontario K1S 5B6
613-520-2600 Ext: 4085
ethics@carleton.ca

CERTIFICATION OF INSTITUTIONAL ETHICS CLEARANCE

The Carleton University Research Ethics Board-B (CUREB-B) has granted ethics clearance for the research project described below and research may now proceed. CUREB-B is constituted and operates in compliance with the *Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans* (TCPS2).

Ethics Protocol Clearance ID: Project # 111184

Research Team: Alex Mesley (Primary Investigator)
Dr. Stephen Fai (Research Supervisor)
Dr. Robert Biddle (Research Supervisor)

Project Title: Citizen Understanding of Alternative Voting

Funding Source (If applicable):

Awards File No	Title	Status	
103728	New Directions in Usable Security	Active	A. CORIS Awards

Effective: **July 12, 2019** Expires: **July 31, 2020.**

Please ensure the study clearance number is prominently placed in all recruitment and consent materials: CUREB-B Clearance # 111184.

Restrictions:

This certification is subject to the following conditions:

1. Clearance is granted only for the research and purposes described in the application.

2. Any modification to the approved research must be submitted to CUREB-B via a Change to Protocol Form. All changes must be cleared prior to the continuance of the research.
3. An Annual Status Report for the renewal of ethics clearance must be submitted and cleared by the renewal date listed above. Failure to submit the Annual Status Report will result in the closure of the file. If funding is associated, funds will be frozen.
4. A closure request must be sent to CUREB-B when the research is complete or terminated.
5. During the course of the study, if you encounter an adverse event, material incidental finding, protocol deviation or other unanticipated problem, you must complete and submit a Report of Adverse Events and Unanticipated Problems Form, found here: https://carleton.ca/researchethics/forms-and-templates/

Failure to conduct the research in accordance with the principles of the *Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans 2ndedition* and the *Carleton University Policies and Procedures for the Ethical Conduct of Research* may result in the suspension or termination of the research project.

Upon reasonable request, it is the policy of CUREB, for cleared protocols, to release the name of the PI, the title of the project, and the date of clearance and any renewal(s).

Please contact the Research Compliance Coordinators, at ethics@carleton.ca, if you have any questions.

CLEARED BY: **Date: July 12, 2019**

Natasha Artemeva, PhD, Chair, CUREB-B

Janet Mantler, PhD, Vice-Chair, CUREB-B

Appendix B: Consent Form

Carleton UNIVERSITY
Canada's Capital University

Research Consent Text for in-person Survey

Name and Contact Information of Researchers:

Alex Mesley, Carleton University, Human-Computer Interaction, Faculty of Science

Email: alexmesley@cmail.carleton.ca

Supervisor and Contact Information: *Robert Biddle, (RobertBiddle@cunet.carleton.ca), Stephen Fai (Stephen.Fai@Carleton.ca)*

Project Title

Citizen Understanding of Alternative Voting

Project Sponsor and Funder (if any)

NSERC

Carleton University Project Clearance

Clearance #:111184 Date of Clearance: July 12, 2019

Invitation

We are asking you to complete this survey because you are of a Canadian citizen of legal voting age in Canada. This survey is being conducted by *Alex Mesley* of the Carleton University *Faculty of Science (alex.mesley@carleton.ca)* working under the supervision of Prof. Robert Biddle (RobertBiddle@cunet.carleton.ca) and Prof. Stephen Fai (Stephen.Fai@carleton.ca). The study is funded by NSERC.

Objectives and Summary:

The aim of this study is to address the factors required to be met by a voting technology in order to be accepted by voters.

Alternative voting technologies is a term which incorporates several different technologies involved in different steps of the voting process. Most basically, an alternative voting technology is the "means of both casting and counting votes electronically, involving the transmission of ballots and votes via telephones, private computer networks, or the internet" (Essensa, Alternative Voting Technologies Report, 2013). This can include accessible voting devices used by persons with disabilities, optical scan voting systems, touch screen voting machines, telephone network voting, or online voting. As there are a number of definitions for what constitutes an alternative voting technology, the term will be

used here to denote electronic technologies, including the internet, used in the process of marking and/or submitting a ballot (Essensa, 2013).

We estimate that the survey will take about 45 minutes to complete. Your participation in this survey is voluntary, and you may choose not to take part, or not to answer any of the questions. We expect to survey a total of 220 people, 200 participants online, and 20 in person.

Risks and Benefits:

We do not anticipate any risks from taking the survey, nor do we anticipate that you will derive any benefit.

Remuneration:

Participants will receive $15 for participating in this survey.

Withdrawal:

If you decide to withdraw after you submit the survey, we will remove your responses from survey data if you notify the researcher within 1 day.

Confidentiality and Data Storage:

No information that discloses your identity will be requested, therefore no personal information will be released. Research records may be accessed by the Carleton University Research Ethics Board in order to ensure continuing ethics compliance.

All data will be kept confidential.

Data may be shared with colleagues and used in publications, presentations, or future research. The results of this study may be published, but the data will be presented so that it will not be possible to identify you. All research data will be encrypted, or password protected.

Responses to the interview questions will be recorded and stored using a passcode-protected audio-recording device. Recording of interview responses ensures the researcher does not miss important data due to slow note-taking. All recordings will be deleted once the researcher has transcribed them.

After the study is completed, your data will be retained for a period of 1 year and then securely destroyed.

REB Review and Contact Information:

This project was reviewed and cleared by the Carleton University Research Ethics Board. If you have any ethical concerns with the study, please contact the Ethics Board Chair by phone at 613-520-2600 ext. 4085 or by email at ethics@carleton.ca.

Direct Consent:

I voluntarily agree to participate in this study.

_____ _____

Signature of participant Date

I voluntarily agree to have my interview responses audio recorded for the purposes of this study.

_____ _____

Signature of participant Date

Appendix C: Survey

Online Survey

Demographics

1. Gender?

Female	Male	Non-Binary	Other	Prefer not to say

2. Age?

18-24	25-34	35-44	45-64	65-74	75+

3. What is your highest level of education achieved?

Did not complete high school	High school graduate, diploma or equivalent	Trade/ technical/ vocational training	College diploma	Bachelor's Degree	Master's degree	Professional degree	Doctorate degree

4. What is your average household income?

Less than $20,000	$20,000 - $44,999	$45,000 - $69,999	$70,000 - $99,999	$100,000 - $149,999	$150,000 - $199,999	$200,000 or more

5. In what city do you live and vote?
   a. _____

Questionnaire

TIPI

I see myself as:	Strongly Disagree			Neutral			Strongly Agree
	1	2	3	4	5	6	7
Extraverted, enthusiastic.							
Critical, quarrelsome.							
Dependable, self-disciplined.							
Anxious, easily upset.							

Open to new experiences, complex.							
Reserved, quiet.							
Sympathetic, warm.							
Disorganized, careless.							
Calm, emotionally stable.							
Conventional, uncreative.							

SeBIS

Question	Strongly Disagree			Neutral			Strongly Agree
I set my computer screen to automatically lock if I don't use it for a prolonged period of time.	1	2	3	4	5	6	7
I use a password/passcode to unlock my laptop or tablet.							
I manually lock my computer screen when I step away from it.							
I use a PIN or passcode to unlock my mobile phone.							
I do not change my passwords, unless I have to.							
I use different passwords for different accounts that I have.							
When I create a new online account, I try to use a password that goes beyond the site's minimum requirements.							
I do not include special characters in my password if it's not required							
When someone sends me a link, I open it without first verifying where it goes.							
I know what website I'm visiting based on its look and feel, rather than by looking at the URL bar.							

I submit information to websites without first verifying that it will be sent securely (e.g., SSL, “https://”, a lock icon).							
When browsing websites, I mouseover links to see where they go, before clicking them.							
If I discover a security problem, I continue what I was doing because I assume someone else will fix it.							
When I’m prompted about a software update, I install it right away.							
I try to make sure that the programs I use are up-to-date.							
I verify that my anti-virus software has been regularly updating itself.							

Question	Strongly Disagree			Neutral			Strongly Agree
	1	2	3	4	5	6	7
I believe that the Internet is a secure environment for voting.							
I would be uncomfortable providing personal information to a third-party company hired by the government to conduct an election.							
I believe any technology set up by the government to conduct an election would be secure.							
I believe that an electronic voting system will prevent tracing ballots to specific voters.							
I believe that an electronic voting system will prevent others from seeing whom I vote for.							
I feel assured that legal and technological structures adequately protect voting processes from malicious forces on the internet.							
Alternative methods of voting are irrelevant if they are not available during the entire duration of the voting period.							
I believe that the technical structures of an electronic voting system will prevent modification of my vote.							
I don’t believe an electronic voting system will ensure my vote is recorded accurately.							

I believe that an electronic voting system will reduce the occurrence of ballot counting errors.							
My voting habits would not change if there were more methods of voting available to me.							
I have skipped voting in the past because it has been inconvenient for me.							
I think that I would find an electronic voting system useful.							
I would be more likely to vote if there were more methods of voting available to me.							
Voting online would enable me to vote more quickly							
I have no difficulty voting with pencil and paper at a polling station.							
Accessing my local polling station is difficult for me (due to distance, location, stairs, physical challenges, etc.).							
I require the help of another person or assistive device when voting.							
Using an alternative voting technology would not make it easier to vote.							
Learning a new way to vote would be challenging for me.							
I believe interacting with a new voting technology would be a clear and understandable process.							