

# The Quota Question

A thesis

submitted by

David R. Goode

In partial fulfillment of the requirements

for the degree of

Master of Arts  
in  
Urban and Environmental Policy

TUFTS UNIVERSITY

Adviser: Molly Mead  
May, 1994

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APRIL 25, 1994

TO THE HONORABLE CITY COUNCIL:

ATTACHED PLEASE FIND, A COPY OF "THE QUOTA QUESTION."  
THIS DOCUMENT INCLUDES AN ANALYSIS OF VOTING PATTERNS IN CITY  
ELECTIONS. IT ALSO FINDS EVIDENCE OF BIAS IN THE EXISTING SYSTEM USED  
TO ALLOCATE SEATS IN CITY ELECTIONS.

SINCERELY,

*David R Goode DMD*  
DAVID R. GOODE

To the Honorable City Council:

Attached please find a copy of "The Quota Question".  
This document includes an analysis of voting patterns in  
City elections and finds evidence of bias in the existing  
System used to allocate seats City elections.

Sincerely,



David R. Goode  
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## Certificate of Fitness

To the Dean of the Graduate School:

This certifies that the undersigned, appointed to determine the fitness of

David R. Goode

for the degree of

Master of Arts in Urban and Environmental Policy

have examined the candidate's thesis on the subject:

*The Quota Question: identifying bias associated with election quotas used in single transferable vote proportional representation elections*

and have found it satisfactory.

This certifies further that the candidate this day has successfully passed the customary examination. We recommend, therefore, that the degree be awarded under the usual conditions.

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Signed:

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***The principle of voting makes an election more a game of skill than a real test of the wishes of the electors, and as my own opinion is that it is better for elections to be decided according to the wish of the majority rather than those who happen to have the most skill in the game, I think it desirable that all should know the rules by which this game may be won.***

-Lewis Carroll  
1876

This thesis is dedicated to  
**City Councillor Sheila T. Russell**  
and the memory of  
**Mayor Leonard J. Russell**  
*good sports of the game*

## **Abstract**

The City of Cambridge has used single transferable vote proportional representation (STV PR) to elect municipal officials for more than 50 years. It remains the last of more than 20 municipalities in the country to use this unique system. Proponents of STV PR, including this author, assert that this election system is superior to the more common plurality and majority systems in widespread use in the United States. While many studies also support this claim, there has been little debate over the question of whether the system of STV PR is as accurate and fair as possible. This work contends that the system of PR in use in Cambridge is not as fair and accurate as possible. Consequently, it makes recommendations for improving the system presently in use.

The issue of accuracy and fairness centers on the definition of quota in STV PR. Quota is the proportion of votes equal to one seat in the representative body. When STV PR was first proposed in the 19th century, proponents defined quota by dividing the total votes cast by the number of seats available. In 1859, a proposal to reduce this quota was widely accepted. This reduced quota remains the standard for STV PR elections. It is the quota presently used in Cambridge elections.

This thesis contends that proponents of the reduced quota ignore several important characteristics of STV PR that result in bias under the reduced quota. The first is the differences between ordinal and categorical ballots. STV PR is an ordinal ballot system while other versions of PR are categorical ballot systems. This distinction and the correspondingly different effects of changing the quota were not included in the historical assessment of the reduced quota. Similarly, this thesis finds that social factors affect ordinal voting patterns. Thus, this thesis addressed the question of whether changes in quota will bias the system toward one type of voting pattern over another. The findings culminate in a strong argument for reinstating the original quota in STV PR elections.

## **Acknowledgments**

To my Parents, I want to say thank you for your eternal patience and support, not so much in regard to this work, but rather during the long, disjointed and confusing process of getting on the right track. A special thank you to Elizabeth, for her moral support and for spending endless hours of boredom in front of my computer helping me with the data entry for this work. Even while she was treating my thesis like it was the most important thing in the world, I could never imagine anything more important than having her in my life.

I also want to thank my brother Ken, not only for an extremely constructive critique of an early draft, but for teaching me to "write like people read" years ago when school teachers were putting me to sleep. Thanks also to Robert Winters, for helping me with "da math" and for putting in an important and greatly appreciated effort as a reader on my thesis committee. Thanks also to Abe Rosner for the jazzing up. Last but certainly not least, I want to thank my pal Carla for telling me to go to school.

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# **The Quota Question**

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## Introduction

The proportional representation (PR) election system used in Cambridge was first proposed in 1938. More than fifty years later, Cambridge remains the last municipality in the country to elect a City Council using PR. During its heyday, PR was used in 22 municipalities in the United States, including seven Massachusetts cities.

Yet even at its peak of popularity, PR was never fully accepted by the American electorate. In the eyes of rank and file Americans, PR remained largely a reformers experiment. A relatively intricate system almost always championed by upper class interests, PR was never allowed to be judged on its own merits.

PR in American municipal elections was usually presented as an alternative to elections dominated by political machines. In cities where PR was adopted, these political machines often exacerbated the lingering doubt surrounding PR and worked diligently for its repeal. When asked what he thought of PR, then Governor Al Smith of New York said "of all the wild-eyed crazy, non-sensical things that have ever afflicted the City of New York, I certainly think there is nothing that equals PR."

Governor Smith's sentiment rang through most of the political machines effected by the spread of PR. With the publication of Professor Hermens book *Democracy or Anarchy?* in 1941, PR opponents found a champion that asserted a link between the use of PR and the rise of fascism in Europe, including the rise of Hitler in Germany. While many of the PR systems examined by Professor Hermens resembled the systems used in American elections in name only, PR opponents began branding the fledgling election system as dangerously un-American.

In many cities, PR in the United States fell victim to the social ills that flared during the post World War Two period. When a communist won a seat in a New York city PR election, the cold war mentality fostered arguments that PR represented a threat to democracy. When a second communist won a seat in New York the fate of PR was sealed. New York repealed PR in 1947.

The PR system in Cincinnati faced a similar fate due to racial intolerance. An informal tradition of PR elections in Cincinnati dictated that the City Council elect as Mayor the member receiving the largest number of first preference votes. When a black candidate named Ted Berry won the most first preference votes, growing concern over the increased representation of racial minorities peaked. Although Mr. Berry, an ardent supporter of PR, offered to accept the position of Vice Mayor in order to quell the growing opposition to PR, the city repealed its use in 1957. More than a decade later, Mr. Berry was elected Mayor under a plurality election. This hindsight shows PR did not "over-represent" minorities as many of its opponents argued. Rather, PR was used as a scapegoat for racial intolerance.

The City of Cambridge did not follow the path of other PR municipalities. Consequently, Cambridge provides the perfect case study to consider both the merits and failings of PR in the context it deserves. It is not necessary to repeat the almost universal conclusion that PR systems

are better, fairer and more accurate than plurality systems. That point has been made repeatedly for more than a century and is presently being echoed in a contemporary resurgence of interest in PR.\*

This thesis will refrain from judging PR on the plurality standard and will examine the fine points of the PR system used in Cambridge. It will consider how accurately PR works in a Cambridge City Council election and will examine issues that may lead to significant improvements in the ability of PR to elect fair representation. In short, this analysis will consider whether the PR system used in Cambridge is working as well as it should.

This work provides evidence to prove that the PR system in Cambridge does not value all ballots cast in the election as equally and objectively as it could. Moreover, it presents evidence showing that this PR system incorporates significant advantages to higher status voters that do not exist in other election systems.

The fact that PR provides advantages to higher status voters does not justify the use of other election systems. While other election systems may favor lower status voters, this characteristic does not necessarily make them more appropriate. For example, American plurality elections have historically provided opportunities for working class constituencies to gain political power over long standing upper classes. The history of Irish political power in Boston is one case in point.

The increase in working class political power is not necessarily synonymous with fairness, however. While plurality elections allowed some working class constituencies to gain political power, it did not distribute that power equitably among the entire working class. Black constituencies in Boston, although largely working class, were typically denied the political representation due their numbers. This same pattern is found in other areas where working class constituencies were able to gain significant political power.

In reality, PR is one of the best systems available for ensuring that all constituencies gain their fair share of representation in an elected body. Yet this statement raises the question of what is meant by proportional representation. I assume that proportional representation refers to numbers of voters. Therefore, the goal of PR is to represent different groups in accurate proportion to their numbers in a community. Of course, each voter is given the province to decide which group he or she will belong.

This thesis outlines how certain aspects of the Cambridge PR system define proportional representation in terms of a constituency's power rather than in terms of total number of voters. In part, this work asserts that the PR system in Cambridge values the efficient use of voters in a constituency inordinately more than the total number of voters in a constituency. This results in larger, but less efficient constituencies being denied a certain measure of their just representation while smaller, more efficient constituencies are awarded more representation than they deserve.

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\*Those interested in finding out more about the resurgence of PR should refer to *Real Choices, New Voices* by Doug Amy. In addition, George Pillsbury's paper *Proportional Representation Voting: A New Test for Democracy?* provides interesting insights into the effects of PR on voter participation in Cambridge.

The aspects of PR that create these problems are not endemic to the type of system. They are caused, in large part, by the miscalculation of appropriate standards for defining proportional representation. The most notable example, and the main focus of this work, is the quota used to define what constitutes a representative proportion. This work asserts that a change in the quota will move Cambridge away from a PR system overly influenced by the power of a constituency. In its place will be a PR system that allocates representation based more completely on the number of voters willing to form a constituency. In other words, it will create a PR system based more on consensus and less on efficiency.

The evidence presented here cannot be interpreted as an indication of inferiority of PR relative to more well known election systems. Rather it is presented as an effort to make PR realize its full potential and create representative bodies that accurately reflect the wishes of the electorate.

Chapters 1 through 4 provide a useful foundation for understanding the more technical aspects of this thesis. They outline the social issues affected by the use of PR in Cambridge and present a brief overview of the development of PR. Chapter 3 provides a detailed introduction to the goals, functions and liabilities of different election systems. By comparing the mechanics of these systems, Chapter 3 creates a frame of reference useful to readers unfamiliar with the details of election systems. These chapters are a relatively "easy read" for persons with an interest in elections.

Chapters 5 through 8 constituted the analytical aspect of this thesis. The information presented in these chapters is not particularly difficult to understand. However, it is presented in a progressive format that constructs the argument piece by piece. Therefore, I consider chapters 5 through 8 to be relatively inseparable. In order to understand the full justification for the arguments presented in this thesis, chapters 5 through 8 should be read successively.

Chapter 9 closes the thesis by linking these two halves. It draws on the information presented in Chapter 2 in order to outline how technical differences associated with quota translate into political motivations. It discusses the goals of representative democracy and how different aspects of PR create incentives or disincentives for meeting these goals.

## **Chapter 1: The Advent of PR in Cambridge\***

Consider the strong feelings evidenced in Governor Al Smith's statement about PR. Even to those unfamiliar with the operations of PR or any other kind of voting system, it is quite clear that this issue is one of emotional intensity. Like New York City, the City of Cambridge experienced these high stakes confrontations during the battle to make proportional representation the official voting system for electing municipal representatives. It was, according to one key player in the debate, "one of the most thrilling political melodramas ever staged in Cambridge - a cliffhanger, a classic."

At this point, it is not necessary to understand the intricacies of voting systems to appreciate the climate that brought PR to Cambridge. Consequently, I will discuss the specific details of voting systems in a later section. It is important to understand the social dynamics of the Cambridge community in the years just prior to World War II. Although Cambridge has changed considerably in the past fifty years, the dynamics present at the beginning of PR's tenure in Cambridge still affect its operation today.

### ***The Right Plan:***

In Massachusetts, municipal voting systems are inextricably linked to the type of administration used in government. As you will read, the administration of government was an important factor in the Cambridge PR debate.

Prior to June 1st, 1938, Massachusetts law allowed only four types of municipal government operation. These were, and are still, known as plans A-D. All of these plans included some type of majority system voting. However, they differed in the operational aspects of government. Plans A-C designate the Mayor as the Chief Executive Officer charged with the powers of administration as well as the responsibilities of representation. Plan D differed from these other options. Plan D allows a city council and ceremonial mayor to be elected while the operational aspects of the municipality are performed by an appointed City Manager. Thus, the City Manager is hired by the city council to act as Chief Executive Officer.

In 1938, Cambridge operated under Plan B. The city was governed by 15 City Councillors, 4 of whom were elected at large. In addition, the Mayor (CEO) was elected at large, bringing the total number of elected officials to 16.

On June 1st, 1938, Massachusetts Governor Charles Hurley signed a bill making a new form of government available to Massachusetts municipalities. This new form, known as Plan E, consisted of a City Manager as Chief Executive Officer with a city council elected at large by PR.

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\* Although this chapter is the culmination of many conversations and readings, its content and structure is based around the writings of Eliot Spalding, Editor Emeritus of the Cambridge Chronicle. In particular, I rely heavily on his article "Plan E Debate Split the City in 1938" which appeared in the Chronicle on October 15, 1987 and "How City's Plan E System Came to Be" which appeared in the Chronicle on November 30, 1987.

Shortly thereafter, the Cambridge Committee for Plan E was established. Headed by John Landis, Dean of the Harvard Law School, The Committee for Plan E received most of its support from the elite academic community that was, and remains, closely associated with Harvard University

Opposition to the movement to change the city charter came from the city politicians and employees as well as the working class areas of the city. The roots of these communities reach back to the early and mid-19th century when Cambridge attracted immigrants and other working class families to the industrial boom of East Cambridge. They shared very little with the world class elite of Harvard University.

Feelings of resentment over the proposed charter change ran so strong that City Councillor John Toomey made national headlines when he introduced a proposal demanding that Harvard University be declared a separate city. His motion passed quickly through the City Council without opposition. With the lines clearly drawn, the showdown between the two opposing sides began in earnest. While the issue of Plan E also included a change to City Manager form of government, the initial battles centered entirely on the issue of proportional representation. Calling it the "fairest and most democratic form of voting known" the Committee for Plan E began to collect petition signatures to have the charter change question put on the ballot for the November, 1938 election.

The City Council turned up the heat on the issue when Council President Thomas McNamara initiated an investigation of the petition procedures used by the Committee for Plan E. Attorney George McLaughlin, a prominent Cambridge resident associated with Harvard University represented the Committee for Plan E and advised all committee members to refuse answers to questions posed by the City Council. Tempers flared when it was discovered that the Committee for Plan E had paid some people to collect petition signatures. In the end, George McLaughlin and the Committee for Plan E had the upper hand when McLaughlin proposed that the City Council had no power to investigate the issue. McLaughlin asserted that the authority to investigate was given solely to the State Ballot Law Commission, where protests against the Committee for Plan E's practices were eventually filed.

Time, however, was running out for the Committee For Plan E. While the City Clerk had certified more than the required number of signatures, the City Council refused to forward the petition to the Secretary of State's Office before the October 8th deadline since there were protests still pending at the Ballot Law Commission. However, the Committee for Plan E had not yet exercised the full influence of its formidable power base.

When the Ballot Law Commission dismissed the last protests against the petition process at 9:30 AM October 8th, some impressive political maneuvering took place. Acting on the request of Committee for Plan E attorney McLaughlin, a State Supreme Court Justice ordered the Cambridge City Council to transmit the petition to the Secretary of State's Office by days end or appear at a Supreme Court hearing at 3:00 PM, October 8th. When the City Council refused to act on the petition, a summons was served and the Court again ordered the City Council to comply or face legal action. That evening the City Council voted to pass the petition to the

Secretary of State without debate. Secretary of State Frederick W. Cook logged in the petition at 10:25 PM, October 8th, only one and a half hours before the deadline. It was never clearly explained who had convinced the Secretary of State to keep his office open late. In any case, the Boston Globe front page headline of October 9th read "Cambridge to Vote on Plan E."

For the month before election day, the battle focused entirely on the issue of PR. Interestingly, the only significant reference to the change to the City Manager form that accompanied Plan E was made by the Communist Party of Massachusetts. While they emphatically supported proportional representation, they denounced Plan E as a whole due to the City Manager stipulation. This was done much to the delight of the Committee for Plan E, which tried desperately to distance itself from association with the communists. On election day 1938, the residents of Cambridge voted to oppose Plan E. 21,722 persons voted against it while 19,995 voted for its adoption, a margin of 1,767 votes.

### ***Plan E- The Sequel:***

Like many elite political organizations, the Committee for Plan E had no trouble retaining the resources needed to sustain its existence after defeat in 1938. Over the next two years, the Committee for Plan E continued to bring the issue to the people of Cambridge. However, by the time the 1940 election season approached, the tone of the campaign had changed dramatically compared to the turbulence and divisiveness of 1938.

For example, when Cambridge Mayor John Lyons invited Professor F. A. Hermens of Notre Dame to speak in Cambridge, John Landis, still Chairman of the Committee for Plan E, did not respond. In reference to the strong Irish heritage of the Cambridge working class, one advisor to the Committee for Plan E reportedly told John Landis not to challenge Professor Hermens. "This is Cambridge," he said, "and in Cambridge Notre Dame always beats Harvard 52 to nothing." The decision of the Committee for Plan E not to make proportional representation the major issue during the 1940 campaign would prove decisive.

### ***Fiscal Troubles:***

While Mayor Lyons may have been able to take the upper hand in the PR debate, he fell under attack for his budget policies. The Cambridge Tax Payers Association, an organization that found support in the well-to-do areas as well as some working class areas of Cambridge, worked to protest the budget Mayor Lyons proposed for 1940.

Several events contributed to the Mayor's problem. First, the budget was the largest in the city's history resulting in an unprecedented increase in the tax rate. Second, the budget was submitted without detailed allocations for each department, only lump sums were recorded. Commenting on the Mayor's budget, a Cambridge Chronicle-Sun editorial said that if the city officials could not hold the city tax rate down, they would have no one but themselves to blame if the city turned to Plan E as "the only way out."

Fiscal problems intensified when the Cambridge Tax Payers Association began its "Call to Arms" campaign. By jamming City Hall with supporters, the Association forced the City Council to reject the mayor's budget. In addition, State Senator Arthur Blanchard submitted a bill asking for a state commission to investigate Cambridge city affairs. Once again, the Cambridge Chronicle-Sun ran an editorial stating that the only way to fend off Plan E in the coming election was to hold down the city tax rate.

While public attention remained focused on the city's budget problems, the Committee for Plan E unceremoniously collected petition signatures for the coming 1940 election. In June, the City Council, at odds with the mayor about the budget and weakened by public dissatisfaction, passed the properly certified petition to the Secretary of State without incident.

While the issue of PR was debated as election day approached, the Committee for Plan E continued to emphasize that an experienced professional, not a politician, would be running the city under the Plan E. The new approach worked. On election day Plan E won by roughly 7,500 votes.

## **Chapter 2: A Brief History of Class Conflict in Cambridge**

### *Historically Two Classes:*

Beginning in earnest during the early 19th century, Cambridge became a divided town. As working class communities began to establish roots in Cambridge they began to conflict with the elite communities associated with, and largely sustained by, the presence of Harvard University. These elite communities trace their roots to the powerful mercantile class of pre-Revolutionary America. Thus, the political divisions during the events of 1938-40 were only the latest manifestation of a long established conflict of interest.

With the industrialization of East Cambridge and Cambridgeport during the 19th century, immigrants attracted by factory jobs began to rapidly increase the population of Cambridge. Repeated waves of Irish, Italian, Polish, Greek, German, Portuguese and Asian immigrants sought a new life in Cambridge. Over time these groups, particularly the Irish and Italians, became more established and moved out to build the neighborhoods of North and West Cambridge. North Cambridge also became the focal point of a strong French-Canadian community. In the process, these groups literally encircled the elite communities of "Old Cambridge" and began to gain power within the political system of the city. The residents of the elite communities became so alarmed at the working class growth rate that a portion of its residents once petitioned the General Court (State Legislature) to define Old Cambridge a separate municipality. The effort never developed into a truly feasible proposal, however (Appellman, 1985).

### *The 3-D Class Structure of Cambridge:*

Over time, the most successful working class groups began to move closer to middle class status. Increased political power brought new job opportunities for many working class communities. The economic boom of post war America added to this effect as did the power of labor unions during the early to mid-twentieth century. Although the economic prosperity created by these factors moved many Cambridge communities into the middle class, they maintained the perspectives and values typical of working class communities.

During the establishment of the middle class in Cambridge, new arrivals continued to bolster the ranks of the working class. African-American migration from the south helped preserve the heritage of working class communities in Cambridge. Thus, the class structure of Cambridge began to change from a two tiered structure to a three tiered structure. New immigrants that perhaps did not adapt as easily as previous arrivals as well as long time residents suffering from social barriers to upward mobility began to dominate the Cambridge working class. As the post war economic boom began to wane, the status of this community became more pronounced. Meanwhile, the families of many original working class groups were largely able to gain the power and prestige of middle class status. The elite communities persevered due, in large part, to the prominent stability and growth of Harvard University.

The recent history of Cambridge has blurred the lines of demarcation within this three tiered structure. The dramatic expansion of Harvard and MIT introduced a new breed of elite to

the city. Intellectuals that are clearly upper class, but not directly associated with the historical elite community are an ever increasing influence, often changing the nature of traditionally working class neighborhoods. Moreover, the decline of the manufacturing base in the Northeast United States has slowed or reversed the upward mobility of some middle class residents, blurring the lines between working class and middle class communities.

Like many other urban areas, Cambridge also experienced an influx of a professional class during the 1980's. This phenomenon was exacerbated by the extension of the MBTA Red Line from Harvard Square to Alewife Station. With the addition of easy access to Boston, the traditionally working class neighborhood of North Cambridge came to be increasingly viewed as a desirable bedroom community for professional class homebuyers. Unprecedented increases in real estate values during the same period added to the pace of transformation. Many working class families "cashed in" on their increased values and move away. Other were forced out by rising operating costs and property tax assessments. In other neighborhoods, renters were often forced out due to rapid increases in condominium conversions.

Some working class areas remained relatively unchanged. East Cambridge, is presently surrounded by high tech development and is separated from the Charles River by luxury waterfront property. However, it remains strongly reminiscent of the working class industrial communities of the last century and remains a focal point for new immigrants.

Thus, contemporary Cambridge is a hodgepodge of different cultures and, consequently, different classes. The geographic denominations that defined these differences in the early part of the century, although somewhat recognizable, have been disrupted by more recent economic and social patterns. However, Cambridge retains a basic three dimensional class structure. It is home to extremely wealthy and/or highly educated individuals of the upper class. It is home to a financially secure, middle class of relatively limited educational attainment. In addition, it is home to a significant poor, working class community with limited options, security and mobility.

### *The Political Significance of a 3-D Class Structure:*

Any game changes dramatically when the number of opposing teams increases from two to three. In this respect, the game of politics in Cambridge is no different than any other game. During the initial period of industrialization in Cambridge, class conflict was bipolar, with working class communities challenging the sovereignty of the elites and vice-versa. The emergence of the three dimensional structure created new possibilities of coalition and opposition amongst the new structure of classes.

Political coalitions among different classes change dramatically from issue to issue. During much of this century, the middle class and working class in Cambridge remained a formidable voting bloc. While the upper class of Cambridge maintained significant political, commercial, legal, and social influence in and around the city, the middle and working class communities dominated the city's political system with the power of sheer numbers. This remained the case both before and after the advent of PR.

As differences between middle and working class communities became more pronounced, the strength of this voting bloc waned in certain areas. Upper class constituencies often presented themselves as champions of the working class communities regardless of vast differences in culture and ideology. Thus, upper class interests began to offset some of the middle/working class political dominance of the last quarter century.

The most fundamental, dramatic, and enduring example of a working/upper class political coalition surrounds the issue of rent control in Cambridge. The ability to purchase and maintain real estate remains the most significant benchmark separating the working class from the middle class in Cambridge. The issue of homeownership has traditionally marked the most volatile point of tension in any working/middle class political coalition. Working class residents seek the same level of sovereignty and security as their middle class counterparts, competing with them within a market of limited housing resources. While there are significant exceptions, a rule of thumb for understanding this dynamic in Cambridge remains: The middle class are landlords, the working class are tenants. Although they are likely to share similar histories, occupational classifications and, in many cases, income level, their class status is largely linked to their control of property.

Housing rights advocacy in general, and rent control policy specifically, have increased the tension between Cambridge's middle and working class residents over the past 25 years. As working class tenants obtained more rights as occupants of property, sovereignty and security became less synonymous with homeownership. To its credit, the housing rights movement succeeded in gaining the fruits of middle class status, (sovereignty and security of home) for many working class residents who cannot afford to purchase property. However, it is important to understand that the price of these gains has been a dramatic weakening in the ability of these two groups, of largely similar means and values, to work together effectively for other political gains.

In contrast, the housing rights movement in general and rent control policy specifically have fostered an unusually strong political coalition between working class and upper class communities in Cambridge. The foundation of this coalition is the fact that upper class and working class constituencies are rarely competing for the same pool of resources. Therefore, upper class and working class interests are intrinsically able to coalesce. Yet lack of competition is not in itself the impetus for coalition. The true recipe for coalition is the propensity to create mutual gain. Working class and upper class constituencies in Cambridge formed a strong political coalition because both groups recognized an opportunity to gain from the venture.

The gains available to working class constituencies are self evident. The support of upper class constituencies provides the political and professional clout needed to gain and maintain rights formerly the sole province of middle class standing.

The gains available to the upper class are not as obvious. Although there is sincere motivation to assist those they perceive as less fortunate, this factor alone cannot account for the strength of the working/upper class coalition. The motivation for upper class participation in this coalition is to achieve the political clout needed to re-gain control of the city government. Granted, some people of middle class roots, particularly those in the professional class, often

assimilate into the upper class value system. Yet more often the upward mobility of the traditional middle class (most notably its increased political influence) with its significantly different culture and values is often perceived as a threat to upper class values. From the administrative priorities of the city government to the vision and operation of the school system, middle and upper class values clash consistently. The intensity of these clashes increases when the rate of middle class power increases faster than middle class assimilation into the upper class. Thus, the primary incentive for upper class participation in a working class coalition is the opportunity to control the political influence of the middle class.

Middle class interests typically do not resent the efforts of the upper class to control middle class influence. Although often contentious, the political battles that take place between the middle and upper class interests are generally considered "fair fights." Rather, the middle class greatly resents having the foundations of middle class status eroded by upper/working class coalition. In other words, the middle class doesn't inherently resent a "face to face" fight with the upper class over electing representatives, influencing policy, etc. It accepts this conflict as natural and expected. What it does resent is an upper class "end run" to create a coalition with working class communities in order to win out over middle class interests. The middle class views a face to face fight as fair. It views being trapped in the middle by an upper/working class coalition as unfair. The middle class doesn't resent being punched in the face by the upper class. It does, however, resent being stabbed in the back.

The middle class resentment associated with an upper/working class coalition is rooted in the perception that this coalition rarely includes an even distribution of power between the coalition partners. The middle class perceives the upper class as a manipulator of the working class. Since working class and middle class residents often share similar cultures, histories, and values, this manipulation and the control it affords the upper class is perceived as an insult to the middle class.

The superior resources, connections and status of the upper class gives them the dominant role in the upper/working class coalition. The coalition itself allows them to maintain the dominant role over the middle class. In this manner, the sovereignty of upper class superiority is preserved and perpetuated. The coalition process gives the working class the perception that they are gaining on the middle class. Conversely, the power the coalition removes from the middle class gives them the perception that they are falling back into the working class.

Much of the ill feeling regarding erosion in the foundations of middle class status stems from different perceptions regarding the significant indicators of class status. In general, the issue of homeownership is a less significant indicator of class status in upper class constituencies. Indicators such as educational attainment, occupation and wealth (as opposed to income) are generally more significant indicators of class status in upper class constituencies than is homeownership. Because of these factors, upper classes are less likely to perceive changes in property rights as a threat to class status.

Since the middle class in Cambridge does not significantly differ from the working class in terms of educational attainment, occupation, or wealth, the attainment of homeownership

becomes the principle indicator of middle class status. When the sovereignty associated with homeownership is reduced by changing property rights, the middle class perceives a much more significant threat to its status than upper class constituencies. Since the upper/working class coalition in Cambridge is largely focused on the issue of property rights, the perception of the upper class using its coalition power to strip the middle class of its status is particularly acute. Thus, the political battles of class in Cambridge are more intense, decisive and destructive.

***Conclusion:***

In concluding this chapter, it is important to emphasize that this discussion has considered how working, middle and upper classes in Cambridge perceive indicators of status as well as threats to status differently. I have argued that housing rights has traditionally been a principal, although certainly not an exclusive, vehicle for class conflict and class coalition between the three broad classes in Cambridge.

Housing issues dominate so much of the political landscape in Cambridge that it is often difficult to remember that the classes competing for influence in Cambridge have broader perceptions that foster broader goals. Housing issues, although extremely important, are largely just the tools of larger causes in the context of political struggle between classes.

## **Chapter 3: Three Election Systems**

### ***Introduction:***

As stated earlier, this work will not seek to compare the operations of different election systems. However, in order to understand fully the PR system used in Cambridge, it is important to understand the inequities of plurality systems since their inequities led to the development of PR. Similarly, it is important to understand the associated PR systems that influenced the development of the particular PR system used in Cambridge.

An overview of the major types of plurality systems will provide the basis of this chapter. From this point I will discuss the major components of the list system of PR. The list system is widely used in national and regional elections in Europe. Although not the first type of PR system developed, widespread use of the list system significantly impacted the implementation of its immediate, but essentially less workable predecessor, the single transferable vote (STV) system of PR.

The STV system of PR is the main focus of all subsequent analysis in this thesis and therefore will be outlined last. The PR system used in Cambridge elections is an STV based system. By making comparisons to plurality and list systems, I will argue that certain aspects of the STV system used in Cambridge are not as unbiased as early STV proponents imagined.

There are other election systems, often referred to as semi-proportional systems, that fit within the range of issues I will be discussing in this section. Examples of these systems include the limited vote, the cumulative vote and the approval vote. However, an understanding of these systems is not important to the arguments of this thesis. Consequently, they will not be discussed in this section.

### ***Plurality and Majority Voting:***

Plurality and majority based voting systems are predominate in United States elections. With the exception of several constituencies using semi-proportional or cumulative voting systems, all elections in the US are plurality or majority based systems. The City of Cambridge and the City of New York Community School Boards are the only constituencies in the US presently using proportional representation.

The term plurality is commonly confused with the term majority. A majority is any amount more than half of the total. In an election, anyone with more than 50% of the total votes has earned a majority of the voters support. Elections that show a majority of support are usually limited to run-off elections between two candidates competing for a single seat.

More often, elections are won by a plurality. A plurality is a collection of votes of any given size in an election. The winning candidate is the person with the largest plurality of votes. In most cases, the largest plurality in an election is much smaller than a majority, particularly in races with a large number of candidates. It is not uncommon for plurality elections to be won by candidates with less than 30% of the votes cast. In the US, students are taught that "majority

rules." In reality, a more appropriate saying is "plurality wins." How these axioms of our government affect each other provides the basis for criticism of plurality-based voting systems.

A perfect example of both plurality and majority systems is the process used to elect the Mayor of Boston. A large field of candidates run in a plurality election where all but the top two finishers are eliminated. The top two finishers then face each other in a majority run-off election in order to elect a mayor.

### ***The Voter Shut-Out:***

In an election where two candidates are running, the winner needs to gain more than 50% (a majority) of the votes cast. However, in an election where four candidates are competing, the winner may only need to collect a little more than 25% of the total votes cast. If the other candidates were to split the remaining votes equally, no single candidate could assemble a larger plurality. Thus, it is possible for a candidate to win this election with as little as 25% of the total votes cast. In races with more candidates competing it becomes even more likely that the winner will have collected significantly fewer votes than a majority. In fact, it is likely that the winner will have collected only a small plurality.

Assume that a candidate is elected with a plurality of 25%. Quite fairly, it can be said that 75% of the voters are not represented by the winner. They are shut-out of representation because they split their support among the unsuccessful contenders. The result is an election where a large majority of voters are represented by an official that did not earn their support.

### ***Strategic Voting:***

I demonstrated that a small minority of voters can coalesce around a plurality winner and exclude a majority of voters. In addition, plurality voting can also lead voters to support candidates that do not represent their interests. This type of behavior is commonly called strategic, sophisticated or insincere voting. These labels do not imply that voters are doing something unfair or unethical. Strategic voting only implies that a voter is giving support to a candidate who is not his or her favorite choice for election (Taagepera & Shugart, 1989).

Why would a voter forgo casting a ballot for a truly representative candidate in favor of one less representative? Earlier I stated that candidates can win election with a small percentage of votes if the remaining candidates split the remaining votes. Thus, voters in plurality elections often fear that splitting the vote may help a highly unfavorable candidate win the election.

A recent example of strategic voting took place in the 1992 presidential election, a plurality contest. Many Democrats initially wanted to vote for Ross Perot rather than Bill Clinton. However, many feared that splitting the available Democratic votes would actually help George Bush win the election. Thus, many Democrats that favored Ross Perot grudgingly voted for Clinton, even though Clinton was not their preferred candidate. The same example works for Republican voters.

Plurality elections with more than three candidates will invariably have some level of strategic voting. Consequently, it is difficult for new candidates and new parties to break into a plurality based political system. Many analyses point to this aspect of plurality elections as a root cause of voter apathy and political gridlock (Amy, 1993).

***Plurality in Single Member District Elections:***

Single member district elections are the most numerous type of plurality election. A representative area, such as a state or town, is divided into a number of independent districts each of which elects a person to represent the residents of that district.

Of course, how the districts are defined has an enormous effect on the outcome of the election. Political parties have a long history of manipulating district lines in order to favor their own interests and still do so today (Amy, 1993). This practice is known as gerrymandering, after former Massachusetts Governor and Cambridge resident Eldridge Gerry. In 1812, Governor Gerry and the Old Republican Party manipulated the state district lines so as to win 72% of the legislative seats with only 49% of the total votes. The district lines defied all reasonable configurations and were based entirely on providing advantage to Governor Gerry's party. One long thin district, resembling the shape of a salamander was the focus of considerable criticism. When a local newspaper editor began referring to this district as a gerrymander, a new axiom for plurality elections was born (Lakeman, 1970).

***Plurality in Bloc Voting Elections:***

Bloc voting, or "at large" elections do not use district lines. Bloc voting systems, often used for municipal elections, allow residents to vote for as many candidates as there are seats available. Thus, if there are 9 seats on a City Council, voters can mark support for up to 9 candidates. The candidates with the 9 highest vote totals are declared elected. While the bloc voting format eliminates the possibility of gerrymandering, it does not allow for accurate representation of voter preferences. Very often, the bloc voting system swings between two extremes. When elections take place between large and well organized parties, it is quite possible for the largest party to win all of the representatives. Consider the following example of the Assembly of New Jersey by Essex County in 1919. Each party supported twelve candidates for twelve seats. The total votes were as follows:

Table 3.1 New Jersey Bloc Voting Example

<i>Party</i>	<i>Total Vote</i>	<i>% Total</i>	<i>% Seats</i>
Democrats	36,568	50%	100%
Republicans	33,075	45%	0%
Socialists	2,906	4%	0%
Tax Party	422	6%	0%

Although the Democrats won exactly half of the total votes, the bloc voting system awarded them all twelve seats in the Assembly. Thus, a well organized party, even with only half of the total votes, can win total representation under the bloc voting system (Hoag & Hallett, 1926).

When candidates in a bloc voting election are not organized into efficient parties, it is possible for a minority of votes to gain a majority of control. Consider the example of the Boston City Council from 1910-1923. During this period, the Boston City Council included three "at large" members chosen in a bloc vote election. In seven of the fourteen years this system was used, the total votes of the defeated candidates exceeded the total votes of the winning candidates. The results of these seven years are listed below (Hoag & Hallett, 1926).

Table 3.2 Boston Bloc Voting Example

<i>Year</i>	<i>Elected</i>	<i>Defeated</i>
1911	63,480	91,287
1912	70,466	71,297
1914	63,699	72,299
1916	108,555	114,352
1917	103,666	163,343
1921	166,048	260,396
1922	67,969	109,385

As mentioned earlier, when the number of candidates in a plurality election increases, the more likely it is that candidates can win with a relatively small percentage of the total votes. Thus, in elections where the number of candidates running is not controlled by organized parties, it is more likely that the winners will have attained only a small percentage of the total votes.

***Summary of Plurality and Majority Voting:***

I have demonstrated that plurality based election systems leave much to be desired in their ability to accurately interpret the wishes of voters. Specifically, I have demonstrated that strategic voting and gerrymandering can severely impact the attainment of fair results in single member district elections.

In addition, I have shown that simply eliminating district lines and single member elections is not enough to ensure fair plurality elections. The bloc voting system, which is a multi-seat election with no district lines, has proven to be greatly affected by the organization of political parties and the number of candidates running for election. While no election system can be considered perfect, plurality based elections do leave much to be desired.

***The List System of PR.***

The list system of PR is quite different from plurality voting. Rather than rely on the "winner-take-all" format of plurality elections, the list system of PR allocates seats based on the percentage of votes received by each political party.

Before the election, each political party participating in the election registers a list (or slate) of candidates with the proper election authorities. There is often a nominal requirement to register as a political party, such as attaining a number of petition signatures. The candidates are listed in an order designated by the political party sponsoring the list. This order of candidates

represents the election priorities of the sponsoring party. The first candidate on the list is the person the party would like to see elected first, etc., etc. Parties can sponsor a list containing as many candidates as there are seats to be filled. Conversely, it is possible to have a "list" of only one name. Obviously, the first candidate on the list has a considerably better chance of election than the last candidate on the list.

Voters choose a list to support from among the lists presented by participating parties. In its purest form, the list system does not require the voter to mark a ballot. The voter simply chooses the list of the appropriate party and presents it to the election official as a vote. The ballot papers are often a different color for each party in order to make the selection and counting process simpler.

For example, let's assume that the Cambridge City Council elected its 9 seats using the list system of PR. In 1991, the total turnout for the City Council election was 22,972 voters. Assume the votes were distributed among the five arbitrary parties shown below.

Table 3.3 Sample List System Results

<i>Party</i>	<i>Vote Total</i>
Democrats	5,106 votes
Republicans	5,000 votes
Green Party	4,500 votes
Socialists	4,366 votes
Labor Party	4,000 votes
<i>Total Votes</i>	<i>22,972</i>

***Establishing the Election Quota:***

Once the vote totals are established, the next step is to award seats in proportion to the number of votes received by each party. This is done by establishing a quota of votes for each seat. Originally, the list system of PR simply divided the total votes cast by the number of seats available. Thus, the quota for our example would be as follows:

$$22,972/9 = 2,553 \text{ ( rounded up to the nearest whole number)}$$

By using this quota, we can assign one seat for each 2,553 votes received by each party. The distribution of seats in our example would be as follows:

Table 3.4 Sample List System Allocation

<i>Democrats</i>	5,106/2,553	2 seats (no remainder)
<i>Republicans</i>	5,000/2,553	1 seat (2,447 votes remaining)
<i>Green Party</i>	4,500/2,553	1 seat (1,947 votes remaining)
<i>Socialists</i>	4,366/2,553	1 seat (1,813 votes remaining)
<i>Labor Party</i>	4,000/2,553	1 seat (1,447 votes remaining)

***Total Seats Allocated = 6 (7,654 votes remaining)***

### ***The Big Problem:***

Clearly, the Democrats are treated fairly in this election. Their proportion of votes is equal to exactly 2 seats with no votes wasted as remainders. Thus, the first two candidates listed on the Democratic party slate would be declared elected to the City Council. However, one sees the big problem with the list system in the Republican vote. The Republican proportion does not divide evenly into the number of seats available. They earned nearly the same number of votes as the Democrats, but are awarded only half of the seats earned by the Democrats. Consequently, they are left with a remainder only 106 votes short of another full quota and a second seat. The Green Party, the Socialists and the Labor party are in the same boat as the Republicans. Each party gained enough votes to earn a single seat, but each was also left with significant votes remaining.

Note that only 6 of 9 seats have been allocated after the distribution. Initially, the list system simply awarded the remaining seats to the parties with the largest remainders. Thus, the Republicans, the Green Party and the Socialists would have been awarded the remaining three seats.

Unfortunately, this procedure created another big problem. By allowing remaining seats to be allocated based on the largest remainders, it became possible for a party to split its support in order to gain more than its proportional share of seats. Let's return to the example of the City Council election to demonstrate this splitting strategy. Assume that the Labor Party registered two lists of candidates and was able to divide its support evenly among the two lists.

Table 3.5 Sample List System Allocation With Split Party Lists

<b><i>Democrats</i></b>	5,106/2,553	2 seats (no remainder)
<b><i>Republicans</i></b>	5,000/2,553	1 seat (2,447 votes remaining)
<b><i>Green Party</i></b>	4,500/2,553	1 seat (1,947 votes remaining)
<b><i>Socialists</i></b>	4,366/2,553	1 seat (1,813 votes remaining)
<b><i>Labor Party #1</i></b>	2,000/2,553	0 seat (2,000 votes remaining)
<b><i>Labor Party #2</i></b>	2,000/2,553	0 seat (2,000 votes remaining)

***Total Seats Allocated = 5 (7,654 votes remaining)***

With the vote split between two lists, the Labor Party is not allocated a seat on the first distribution. Thus, the total number of seats allocated on the first distribution drops to five, with four seats left to be allocated to parties with the largest remainders. While the Republicans and the Green Party still gain a second seat, the Labor Party gains one seat for each of its lists, for a total of two seats. By presenting two lists, the Labor Party is able to shut out the Socialists in the allocation to highest remainders. Thus, rewarding seats based on the largest remainders is proven to be an inaccurate way of achieving proportional representation.

### ***The Droop Quota Solution:***

Essentially, the problem of the list system rested in the remainders. The larger the total remainder, the more difficult it is to allocate seats in proportion to the votes received by each

party. Mr. H. R. Droop, an English Barrister and ardent supporter of PR, devised a new quota formula aimed at reducing the importance of remainders in the allocation of seats. Rather than dividing the total vote by the number of seats to establish the election quota, Droop proposed dividing the total vote by the number of seats *plus one*. The result of this division is rounded to the nearest whole number. In addition, if the result of the division is rounded down, one vote is added to the total of the result. If the result of the division is rounded up, the amount added serves as the extra vote. We can compare the two quotas of our example side by side:

Table 3.6 Quota Formulae

<b>Original Quota</b>	$22,972/9 = 2,553$ (rounded up)
<b>Droop Quota</b>	$22,972/(9+1) = 2,297$ (rounded down) + 1 = <b>2,298</b>

The Droop quota is significantly smaller than the Original quota. Thus, it takes fewer votes for each party to earn seats on the City Council. By allocating seats with the smaller quota, more seats can be allocated on the first distribution. This, in turn, reduces the number of votes remaining after the initial distribution. The following table compares the results of the City Council example using the two quotas.

Table 3.7 List System Quota Comparison

<b>Original Quota</b>	<b>Droop Quota</b>
$5,106/2,553 = 2$ seats (no remainder)	$5,106/2,298 = 2$ seats (510 votes remaining)
$5,000/2,553 = 1$ seat (2,447 votes remaining)	$5,000/2,298 = 2$ seat (404 votes remaining)
$4,500/2,553 = 1$ seat (1,947 votes remaining)	$4,500/2,298 = 2$ seat (154 votes remaining)
$4,366/2,553 = 1$ seat (1,813 votes remaining)	$4,366/2,298 = 2$ seat (96 votes remaining)
$4,000/2,553 = 1$ seat (1,447 votes remaining)	$4,000/2,298 = 1$ seat (1318 votes remaining)
<b>6 Seats Allocated (7,654 votes remaining)</b>	<b>9 Seats Allocated (2,482 votes remaining)</b>

Notice that the Droop quota allocates all nine seats on the first distribution. Consequently, the number of votes remaining falls dramatically. By reducing the need to rely on remainders to allocate seats, the Droop quota provides a much more proportional distribution than the Original Quota.

***A Closer Look at the Original and Droop Quotas:***

The City Council election example demonstrates the effect of the Droop quota on the distribution of seats in the list system of PR. However, it does not exactly describe the Droop Quota. Essentially, the Droop Quota is the *minimum* quota while the Original Quota is the *maximum* quota.

Remember that the purpose of our example election is to distribute a total of 9 seats in proportion to the total vote received by each party. Thus, the quota must be defined so that no more (and no fewer) than 9 seats will be distributed. In our example, dividing the total vote by the number of seats (Original quota) produces the *maximum* quota capable of allocating exactly nine seats. Adding one to the denominator of this formula (Droop quota) produces the *minimum*

quota capable of allocating exactly nine seats. While the two quota definitions are at the opposite ends of a range, they both allocate the same number of seats.

Although both quota definitions will allocate the same number of seats, the Droop Quota allocates seats more efficiently than the Original Quota. In the list system of PR, the Droop Quota has proven to allocate seats with less wasted votes and thus arrives at a more proportionally accurate result than the Original Quota. Because of this, the Droop Quota has been adopted as the quota of choice in virtually all PR systems. However, quota definition is of paramount importance to the fairness of PR elections. Consequently this thesis will address the subject of quota definition again in Chapter 8.

### *Summary of List System PR:*

The list system of PR is a significant improvement over the inaccuracies possible in plurality elections. It insures a more accurate degree of representation for participating parties. However, it maintains two major flaws. First, while the Droop quota is much more efficient than the Original Quota, it does leave a certain number of votes remaining after the final allocation of seats. Consequently, several relatively complex alternatives to the Droop Quota have been devised for allocating seats in list system elections.\*

Second, the list system of PR vests an enormous amount of power in political parties. While this can also be said of most plurality elections, the ability of a party's bosses or insiders to decide which candidates are given the best odds of victory is often distasteful to voters. Consequently, several alternative methods have been developed to provide more choice to individual voters in list system PR elections. These alternatives allow voters some influence in ranking the voters within a particular party list. Despite these improvements, list system candidates must still rely heavily on party support. As Lakeman (1970) points out, "the votes obtained by a candidate are no measure of his personal worth or popularity; they depend almost solely on his party's strength in that constituency and on which of the other parties run candidates there.....All (list systems) have this feature in common: every vote (whether or not given in the first instance to an individual candidate) is, automatically and without further reference to the voter's wishes, added to the total list on which that candidate appears" (p. 104). The problem of party influence is addressed by the STV system of PR.

### *The Single Transferable Vote System of PR:*

Single transferable vote (STV) PR is widely considered to be the most unfettered form of proportional representation. Its name is derived from its hallmark improvement over the list system of PR. The single transferable vote system allows preferences to be expressed for individual candidates. In addition, those individual preferences are transferred freely from candidate to candidate based solely on the wishes of each voter. For example, when a favored candidate is either elected or defeated in the counting process, the ballot in question are

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\* In subsequent years, more complex quota formulas, such as the D'Hondt distribution, were developed to replace the Droop quota in list system elections. The formulas provided techniques for recalculating the quota at certain times during the counting process in order to further reduce the amount of votes remaining at the end of the election. However, since these formulas are specific to the list system of PR, they do not concern the principle goals of this discussion and therefore are not included as part of this work.

transferred to the next favored candidate listed by the voter. Unlike the list system, STV allows each voter to list preferences for transfer without the limitations of party lines. STV is the system of PR used in Cambridge City Council and School Committee elections since 1940. Indeed, STV has proven to be a successful and durable improvement over the plurality elections that preceded its adoption in Cambridge.

STV allows voters to choose freely among the candidates running for office. Unlike the list system, STV does not presume a political party structure. Thus, voting is based solely on how each individual voter rates the representativeness of each individual candidate. The voter truly holds power in the STV system. Unlike plurality based systems, the ability to rank candidates in order of preference reduces the problem of strategic voting. In addition, STV does not require the use of districts, although they can be employed in extremely large elections. Thus, the manipulation of gerrymandering power brokers is minimized.

### ***Quota in STV elections:***

Like the list system, STV uses a quota based on the total number of ballots cast in the election. In addition, the STV system in Cambridge (like virtually all STV systems) uses the Droop Quota formula (the *minimum* quota) to allocate seats to candidates. As discussed earlier, the total ballots cast in the election is divided by the number of seats to be allocated plus one.

In STV, the quota must be achieved by each individual candidate, as opposed to the political parties of the list system. Candidates reach quota through first choice votes and by transfer votes from other candidates. Transfer ballots are based on the preferences expressed on each voter's ballot.

### ***Marking the Ballot:***

The evidence of voter power is found in the voting process of STV. The process, while straightforward, is more involved than plurality or list systems. Voters are given a ballot listing all of the candidates running for election. Each person must vote for candidates in numerical order based on their particular order of preference. The voter's favorite candidate is marked with a #1. The second favorite candidate is marked with a #2. The third candidate is marked with #3.

This voting process continues until all the candidates capable of representing the voter have been marked. There is no limit to the number of candidates a voter may choose to mark. Voters may include all the candidates on the ballot, if so wished. Conversely, voters may choose to vote for only one candidate, forsaking the option of listing other candidates. All ballots with a clear numerical order of candidates, regardless of the length, are counted in the election.

By listing the candidates in order of personal preference, the voter is able to ensure that his or her vote will eventually be counted towards the election quota of a candidate. If the first candidate listed on the ballot is not able to reach quota, the ballot would be transferred towards the election effort of the candidate listed #2. Conversely, if the first candidate has already reached quota and does not require additional support, that ballot would be transferred to the next active candidate listed. As candidates are elected and defeated, ballots continue to be transferred based on the preferences expressed by each voter.

In order to make this idea clearer, it is helpful to translate a typical ballot into narrative form, as if each person dictated their vote into a tape recorder. While the following interpretation will be examined more closely in Chapter 5, an STV ballot is often interpreted in the following manner.

" I would like to be represented by my first choice candidate. But in the event this candidate cannot reach quota or does not require my support to reach quota, I would like to be represented by my second choice candidate. But in the event my second choice candidate cannot reach quota, or does not require my support reach quota, I would like to be represented by my third choice candidate, etc., etc. "

Notice that a ballot is only counted towards one active candidate at a time. Only when a candidate is elected with more ballots than needed, or when the candidate has no hope of election, is a ballot transferred to the next active preference.

### ***Counting the Ballots:***

As mentioned earlier, candidates must reach quota by collecting first choice ballots and transfer ballots. The counting process decides how and when ballots are transferred between candidates. In order to explain this process clearly, I will refer to the distribution table of the 1991 Cambridge City Council election found in the Appendix .

Once the election is closed, the total ballots cast are counted and the quota is established. From this point, the first choice preferences on each ballot are counted and awarded to the appropriate candidate. An exceptionally popular candidate may receive more first choice ballots than necessary to secure election. For example, Candidate Alice Wolf received 4,131 first choice ballots in the 1991 Cambridge City Council election when the quota was set at 2,298.

Rather than let these extra ballots be wasted, the candidate is declared elected and the surplus ballots are distributed to the next preference marked on each ballot. The counting process used ensures that the ballots transferred represent a statistically random subset of the entire first choice total. Although the use of a representative sample introduces the possibility of chance into the election, the amount of chance is exceedingly small. An analysis conducted by Mr. Parker Smith in 1884 studied the effect of chance in the distribution of surplus votes in a test election of approximately 60,000 votes. He found a one in 2,000 chance that the distributions would change by one tenth of one percent (Hoag & Hallett, 1926).

Alice Wolf and Walter Sullivan were the only two candidates to reach quota on first preferences. Thus, the second and third counts listed on the 1991 distribution table are their respective surplus transfers. New totals for all active candidates are established after each distribution.

Once the surplus distributions are finished, the candidate with the fewest number of first choice preferences is declared defeated and his or her ballots are transferred to the next active preference listed on each ballot. For the sake of convenience, the 1991 Cambridge City Council election transfers the ballots of candidates with less than fifty votes each at one time. Thus, the

fourth count on the distribution table is the combined total of all candidates with less than 50 ballots. Once this distribution is finished, new totals are established for each of the remaining candidates.

Next, the candidate with the lowest total vote is declared defeated and his or her ballots are transferred to the next active preference listed on each of her ballots. Once all these ballots are transferred, new totals are established for each of the active candidates and the process begins again. This procedure is repeated until nine candidates reach quota or until some have reached quota but only nine candidates remain undefeated.

### ***Exhausted Ballots:***

If a particular voter does not list a suitable number of preferences, his or her ballot may become exhausted during the counting process. Exhausted ballots are ballots that do not list any active candidates in the remaining order of preferences. Logically, as more candidates are eliminated and elected, the number of exhausted ballots in an STV election tends to increase. Referring to the bottom line of the distribution table, we can see that the percentage of exhausted ballots in each distribution tends to increase with each completed transfer.

To illustrate the reason for the increased exhausted ballots, consider the 14th count of the 1991 election. In this transfer, 1,657 ballots were exhausted since there was only one active candidate left to receive transfer ballots. All other candidates have either been defeated or declared elected. Thus, any ballots not counted towards the election of the final candidate must be listed as exhausted.

### ***Summary of STV PR:***

If one were to highlight the principal drawback of the STV voting system, it would be the relatively intense amount of counting, transferring, and recounting of ballots. Ballots that are allowed to move from candidate to candidate are certainly bound to raise the eyebrows of those suspicious of the integrity of the political process. With so much switching and shuffling, counting and recounting, it is understandable why STV never caught on as successfully as list system PR.

It is ironic that the traits holding back the use of STV also highlight its grandest features. The relatively intricate workings of STV testify to the precise and accurate consideration given to each individual voter. Indeed, the voting process of STV is more involved than the other systems discussed here. However, the amount of information presented regarding each voter's perspective of representation is much higher on an STV ballot than on the ballots of the other systems. Similarly, the counting process of STV is more complex than the other systems discussed here. However, the ability for the system to accurately interpret the wishes expressed on each ballot is higher in STV than in the other systems discussed here.

Assuming the goal of elections is to assimilate the true wishes of the electorate in the most accurate way possible, STV holds significant advantages over plurality and PR list system elections. Its main difficulty is the logistical constraints imposed by its close attention to detail. These are often intimidating to voters, candidates and election officials alike. However, with

technology capable of making a significant contribution to eliminating the traditional logistical challenges associated with STV, rationally justifying the use of less accurate election systems will become increasingly difficult.

Yet the impressive detail and precision capable with STV raise more than questions of logistics. All election systems are based on very subjective criteria of fairness and representation. While STV offers communities the opportunity to be more precise about interpreting the expressions of individuals, it also demands more precision in defining fairness and representation.

## Chapter 4: The Development of PR; An Historical Perspective

### *In the Beginning:*

From the prior discussion, it would appear that the development and implementation of the three election systems discussed in Chapter 3 would chronologically match the order of their presentation. This is untrue. Plurality systems were indeed developed first. However, the concept of PR originally centered around the system of STV. The list system, although inferior to STV, was developed and implemented at a later date. In many ways, the list system remains a compromise between plurality and STV. While more proportional than plurality systems, the list system reduced the logistical and, more importantly, the political challenges presented by STV. Thus, the list system was adopted more readily than STV, even though STV was invented and presented first.

The first proposal stating that representative bodies should proportionally reflect the electing constituency appeared among the political establishment of France and England in the late 18th century. Several speeches and proposals presented at the 1793 French National Convention advocated for a system of PR elections, but were quickly suppressed (Hoag & Hallett, 1926).

In 1820, the French mathematician Gergonne published an article in the *Annales de Mathematiques*. The article outlines a system of election in which "voters would group themselves freely according to their opinions, their interests, or their desires." The article emphasized that any such group, being of proper size, would be able to return one representative to an elected body. However, the article did not offer a mechanism for implementing this type of system (Hoag & Hallett, 1926, p. 163).

Although relatively unknown, an English schoolmaster named Thomas Wright Hill is given credit for developing the first implementable plan for electing a representative body using STV. The biography of his son, Sir Rowland Hill, published in 1880, recounts a diary entry concerning the election of a committee in the Society for Literary and Scientific Improvement. The entry describes "a plan of electing a committee which secures a very exact representation of the whole body." The biography credits the development of the system to Thomas Wright Hill and outlines the process used to facilitate the election. Although Hill's plan did not include a secret ballot, it is the first system to seek proportional representation with a single transferable vote (Hoag & Hallett, 1926, p. 164).

Rowland Hill was later appointed Secretary of the Colonization Commission for South Australia. In this role, Hill introduced a clause that allowed an option for residents of the small colony to elect a representative Councillor by appearing at the election with a quota of 18 persons stating their support for a Councillor. In November, 1840 two members were elected to the Council using the PR option. This election remains the first to elect a public official under a quota-based PR method (Hoag & Hallett, 1926).

The first public STV election using a secret ballot took place in Denmark, 1856. Carl Christopher Andrae, Minister of Finance, devised the first method of STV to mark candidates in

order of preference on a paper ballot. Based on the Constitution of 1855, this method was used to elect 59 members to the Supreme Legislative Council of the Federated Realm of Denmark (Hoag & Hallett, 1926).

The system developed by Andrae was the first STV system to resemble the election system used in Cambridge. However, Andrae, like Hill before him, proposed that the quota be set by dividing the total ballots cast by the number of seats to be allocated.

After the system developed by Andrae was in effect in Denmark, an English Barrister named Thomas Hare independently developed a STV system similar to that of Andrae. In 1859, Hare published the first edition of his book, *The Election of Representatives*. In later years he published four other editions of the same work.

In 1861 John Stuart Mill, a world famous scholar and philosopher, praised Thomas Hare and his system of STV in the book *Considerations on Representative Government*. Mill placed Hare's work "among the very greatest improvements yet made in the theory and practice of government" (Hoag & Hallett, 1926, p. 176). This endorsement bolstered the academic attention given to the Hare system. Thus, modern STV is often referred to as "the Hare system", even though the only STV system to be used in public elections over the next forty years was Andrae's system in use in Denmark. Like his predecessors, Hare proposed using the original quota formula (i.e., dividing the total vote by the number of available seats). This quota also came to bear his name, particularly after H.R. Droop proposed his idea of adding one to the denominator of the Hare quota formula. Modern proponents of STV still refer to these respective formulas as the Hare quota and the Droop quota.

### ***The First List System:***

The earliest conception of the list system dates to 1834 and was proposed by Victor Considerant of France. The original proposal of Considerant was modified by Thomas Gilpin of Philadelphia, who published his version of the list system in 1844 (Hoag & Hallett, 1926).

An organization called the Association Reformiste of Geneva was formed in 1865. By using the refined work of Considerant and other subsequent publications on the list system of PR, the group began advocating for the adoption of the list system for Canton elections in Switzerland (Hoag & Hallett, 1926).

Ironically, it was the works of Hare and Mill that instigated the adoption of the list system in Europe. In 1866 the *Association Reformiste* stated in a report that "we have taken as the basis of our study the works of Mr. Hare. Our plan is, in principle, the plan of that writer." However, the Hare plan seemed "too bold and too foreign to the customs of the Swiss." Consequently, they began to advocate for a list PR election system (Hoag & Hallett, 1926, p. 177).

Historical evidence seems to support the proposition that the list system was adopted because it was simpler and less drastic to implement. In 1895, Ernest Naville, the long time leader of Association Reformiste wrote "I do not mean to say that Swiss reformers considered list voting

as the best in theory. I, for one, would prefer the method which, like that of Mr. Hare, gives the elector a chance of preferential vote without the party official list, for the purpose of realizing better than any other the idea of representation." (Hoag & Hallett, 1926, p. 178).

Clearly, there seemed to be some reluctance among proportionalists regarding the workability of the Hare system in large constituencies. In addition, an 1899 insurrection sparked by dissatisfaction over recent elections prompted the Swiss government to offer PR as an alternative. Since the government agreed to this transition while the threat of additional civil unrest loomed, it is likely that the government saw the list system as a way to preserve, and perhaps improve, the influence of the existing political parties.

By the beginning of World War One, the list system was used in all but a handful of European countries. Some studies linked the subsequent use of the list system to the rise of fascism in post World War One Germany and Italy. However, the system survived these challenges and is still used in many European countries (Hermens, 1941).

### ***PR in the United States:***

The PR movement in the United States began in earnest in 1865 when the popularity of Mill caused the work of Hare to be introduced to Simon Sterne of New York. Mr. Sterne traveled to England to discuss PR with Hare and Mill and eventually returned to lead an election reform movement in the state of New York (Hoag & Hallett, 1926; Sterne, 1871).

In addition, Charles R. Buckalew, a United States Senator from Pennsylvania began to advocate for better representation. Although he shared the same goals of Hare and Mill, Buckalew did not support the Hare system because he viewed it as too complicated. Nevertheless, his Senate position allowed Buckalew to push through many reforms aimed at increasing the proportionality of American elections (Buckalew, 1872; Hoag & Hallett, 1926).

In New York, Sterne and others organized the Personal Representation Society of America. In 1871 Sterne published a book called *On Representative Government and Personal Representation*. The book was originally supposed to be an American version of Hare's works. However, the author focused the attention of the book on the merits of the list system at the expense of the Hare system. Like the Swiss proportionalists before them, the American supporters of reform balked at the relatively complex nature of the Hare system (Hoag & Hallett, 1926).

Interestingly, the first known use of the Hare system in an election outside of Denmark took place at Harvard University in 1870. The Alumni of Harvard nominated the Overseers of the College using the Hare system. William R. Ware, a Harvard alumnus and a professor at MIT, is given credit for proposing the adoption of the Hare system in this election (Hoag & Hallett, 1926).

The PR League of America was formed after proportionalists from around the world met at the 1893 Chicago Worlds Fair. After adopting a platform, the PR League presented a bill in

the House of Representatives which pushed for the adoption of list system PR. The bill sponsor was Tom L. Johnson of Cleveland. In later years, Mr. Johnson would be instrumental in making Cleveland the first city in the country to adopt STV for the election of municipal council seats. (Hoag & Hallett, 1926)

Between 1915 and 1964, PR was used in 22 American cities, including seven cities in Massachusetts. Figure 4.1 shows the history of PR in Massachusetts:

Table 4.1 The History of PR in Massachusetts

City	Dates of Use	Successful Repeal
Cambridge	1940-Present	N/A
Lowell	1944-1958	1957
Medford	1950-1953	1952
Quincy	1950-1951	1951
Revere	1950-1951	1951
Saugus	1948-1951	1951
Worcester	1950-1959	1960

By 1964, there were a total of 49 attempts to repeal PR in the United States. Twenty one of these attempts were successful. This left Cambridge as the only city in the country to use PR in the election of municipal lawmakers. All totaled, there were approximately 180 PR elections in the US between the years of 1915 and 1964.

## Chapter 5: Two Different Ballot Systems

As explained earlier, there are considerable differences between STV and other election systems. One of the most important differences is found in what each system demands from a voter. Essentially, voting is an expression of choice. How a particular voting system interprets the choices expressed by voters can have considerable impact on the outcome of an election.

### *Ordinal and Categorical Ballots:*

Rae (1967) examined how different election systems structure the choices of voters and specify their role in an election. He addressed the subject of voter choice by identifying two basic types of ballot structure; categorical and ordinal. Each of the three systems discussed in this paper are either categorical or ordinal ballot systems.

Categorical ballots limit the voter to choosing one candidate or party to the complete exclusion of all other candidates or parties. The voter cannot qualify or place conditions on the vote cast. Categorical ballots do not allow voters to divide the mandate expressed on their ballot among different candidates or parties. Essentially, categorical ballots force voters to pigeonhole their votes. Plurality and list PR are categorical ballot systems (Rae, 1967; Taagepera & Shugart, 1989).

Ordinal ballots allow significantly more voter choice than categorical ballots. Ordinal ballots allow voters to rank their order of preference for all available candidates. By allowing the expression of priorities, ordinal ballots naturally contain more information about each voter's particular wishes. Thus, ordinal ballots are inherently more accurate than categorical ballots.

Rae (1967) provides a concise distinction between categorical and ordinal ballots:

"The significant difference between these two types of ballot lies in the nature of the role imposed by each upon the voter. Under categorical systems the voter must act decisively, delivering his whole mandate to a single party (or candidate). Under ordinal systems the voter is not required to act so decisively and is allowed to represent his least powerful positive feelings in small parcels of support for each of several parties (or candidates). In the microcosm of the single voter's behavior, categorical systems are distinguished from ordinal systems by their intractable rejection of compromise solutions" (p. 18).

While ordinal ballots provide more expression of choice than categorical ballots, they are by no means perfect indicators of voter preference. Rather, it is significant to understand that ordinal ballots, particularly those used in STV, do not indicate an absolute level of preference for the candidates listed on a ballot. While we can say that a voter prefers the first candidate listed more than the second candidate listed, we cannot infer by how much the first candidate is preferred.

### *The Diminishing Marginal Utility of Ordinal Ballots:*

Marginal utility is a term used by economists to describe an individual's behavior. In academic terms, marginal utility is the "additional satisfaction gained by the use of one more unit of something." It is widely accepted that marginal utility tends to fall as a behavior is repeated. For example, a person who likes ice cream receives more satisfaction from the first ice cream cone than the second ice cream cone. The third ice cream cone has less satisfaction than the second, etc. In 1890 the Economist Alfred Marshall called this "familiar and fundamental tendency of human nature" the law of diminishing marginal utility. Case and Fair define the law of diminishing marginal utility as follows: "The more of any one good consumed in a given period, the less satisfaction (utility) generated by consuming each additional (marginal) unit of the same good" (Case & Fair, 1992, p. 160).

The concept of marginal utility applies to ordinal ballots and provides a framework for discussing ordinal ballot voting behavior. We can assume that the level of satisfaction received by a voter is directly related to the representativeness of each candidate under consideration. We can describe the satisfaction each person receives from listing candidates by using the term voter utility. Thus, the most representative candidate will provide the highest level of voter utility. We can assume that the second choice provides a relatively high level of voter utility, although certainly somewhat less than the utility received by the first choice.

At some point, the level of utility gained by voting for each successive candidate begins to fall off rapidly and the marginal voter utility gained by subsequent choices is minimized. This leads to a higher rate of arbitrary decision making as the number of candidates listed on a voter's ballot grows. For example, the decision between the second and third choices listed is much less arbitrary than the choice between twelfth and thirteenth candidates listed. Since the marginal voter utility continues to fall, the difference in listing the remaining candidates in a distinct order is less critical than in the earlier choices.

In certain cases marginal voter utility may begin to rise again after a certain number of candidates are listed. This happens when a person is voting against certain candidates by placing them far down on the list. In other words, some voters gain utility by voting against least representative candidates the same as voting for most representative candidates. Certainly, some voters have strong negative feelings that prompt them to provide the lowest place possible for unfavorable candidates. Thus, voter utility can also be gained by voting against candidates. By making an effort to specifically list unfavorable candidates after arbitrary choices, voters wishing to express dissatisfaction can increase marginal voter utility as their lists grow longer.

The ordinal voting process ends when the marginal voter utility has fallen to zero. At this point, the voter gains no additional utility by voting either for or against the remaining candidates. Choices between the remaining candidates would be made on an entirely arbitrary basis. Thus, no additional candidates are likely to be included on the voter's list.

### *No Preference Votes:*

What is the significance of a voter ending the listing process before all available candidates receive a listing? How does an ordinal voting system interpret the absence of listings on a ballot? The most obvious answer to these questions is that candidates not given a listing on a ballot are being excluded from consideration by the voter. Certainly, there are voters who abhor certain candidates and feel that the most appropriate way to distance themselves from these candidates would be to exclude them entirely from the listing process. However, one must consider whether an ordinal voting system is capable of interpreting the failure to list candidates as a voter's request to exclude the remaining candidates.

To examine this, we need to return to the definition of categorical and ordinal ballots. Rae states that "In the microcosm of the single voter's behavior, categorical systems are distinguished from ordinal systems by their intractable rejection of compromise solutions." One can restate the premise of this comparison in another way by saying that ordinal ballots are distinguished from categorical ballots by their intractable rejection of absolute solutions. To say that all candidates not marked on a ballot are to be excluded from consideration is to say that the ballot should change from an ordinal ballot to a categorical ballot once the number of candidates listed becomes exhausted.

This interpretation defies the premise of an ordinal ballot. As stated earlier, it is impossible for an ordinal ballot to infer an absolute value for each choice listed. An ordinal ballot tells us that the first choice is stronger than the second choice. However, we cannot know the absolute values of those choices. By assuming that the voter wishes to exclude any candidates not listed would be to apply the absolute value of zero to unlisted candidates. This is beyond the capability of an ordinal ballot system.

To illustrate this function of an ordinal ballot, let's return to the given example. Is the voter who simply excludes abhorrent candidates truly expressing her wishes as effectively as possible? The answer is no. Since ordinal systems can only value choices relative to other choices, the best way for a voter to express dissatisfaction is to list all of the candidates with the worst candidate on the very bottom. This is somewhat counter-intuitive from the voter's perspective. Many voters do simply leave unsatisfactory candidates off their lists. However, it is important to understand that ordinal systems can only interpret unlisted candidates as votes of no preference.

Another example of how ordinal ballots cannot recognize absolute values is found in an old Cambridge election story. All Cambridge count junkies know that one election included a ballot listing a favorite candidate first followed by only one other candidate listed number 3,000 or some other extremely high number. Since the two candidates in question were known to be diametrically opposed politically and philosophically, it was obvious that the voter was trying to say that the second candidate shouldn't be elected if he or she was the last candidate on earth. However, since the ordinal system cannot understand the absolute value of these expressions, the ballot was eventually transferred to the person the voter clearly abhorred as if that candidate was the voter's next highest preference. Since the ordinal system can only interpret relative values,

this voter's interest would have been better served by listing as many candidates as possible between his or her first and last choices. At a minimum, the voter should have left the second candidate off the ballot entirely as an expression of no additional preference.

Thus, what I have demonstrated is that ordinal systems differ from categorical systems in that they cannot allow voters to entirely exclude candidates from consideration. At best, an ordinal ballot can understand that a voter would like to see the least favored candidate considered last. In addition, the only way to assure that the least favored candidate is considered last is to include all available candidates in the listing process.

I have also shown that marginal voter utility tends to fall with each successive candidate listed (negative voting behavior excepted). At some point, the marginal voter utility gained by listing more candidates reaches zero and the voter stops listing candidates. Since the ordinal system cannot exclude unlisted candidates by assigning an absolute value of zero, the absence of listing can only be interpreted as an expression of unknown, but equal value among the remaining candidates. Essentially this is a vote of no preference.

#### *Voter Champions or Slate Support:*

Another critical difference between ordinal and categorical ballots is the expression of support for different candidates. I have already shown that categorical ballots require the voter to choose a single party or candidate to act as champion of their interests. If a voter's champion is elected, the voter is represented. If a voter's champion fails, the voter goes without representation.

This does not occur with ordinal voting systems. Support can be split, as Rae stated, "in small parcels for each of several parties (or candidates)." Since the ordinal ballot allows voters to express more than one preference, we cannot assume that the voter is choosing a singular champion. Indeed, when used in a multi-seat election, the ordinal ballot assumes that a voter's list is the order in which she would like to see the available seats filled. If higher preference choices are not capable of election, the voter expects the available seats to be allocated to the remaining candidates on her list, in the order expressed on the ballot.

In order to illustrate the different assumptions of ordinal system voting, we should return to the narrative introduced in Chapter 3. Most traditional proportionalists (Commons, 1907; Hare, 1867; Hoag & Hallett, 1926; Lakeman, 1970) would assume that a typical ordinal ballot of STV is interpreted as follows:

"I would like to be represented by my first choice candidate, but in the event that this person is not elected, or does not require my support, I would like to be represented by my second choice candidate. But in the event that this person is not elected, or does not require my support, I would like to be represented by my third choice, etc., etc."

This narrative interpretation is inaccurate because it applies the limitations of categorical ballots to an ordinal system. This is an extremely important error. Ordinal ballots do not simply allow categorical support for one candidate to be moved around based on preference. Rather, ordinal ballots allow support to be spread among any given number of candidates. Ordinal ballot voters in a multi-seat election simultaneously support a slate of candidates that expresses choices ranging from most favored to least favored. Thus, a more accurate interpretation of an ordinal ballot would be as follows.

"There are nine seats to be filled in this election and I have ranked the candidates in an order that best represents my priorities as a voter. I would like to see the nine seats allocated based on the order I have expressed on my ballot. If it happens that my support is not needed, or is not able, to satisfy my initial priorities, I would like my ballot to assist my remaining priorities in the order I have expressed on my ballot."

An example of the difference in these two interpretations can be demonstrated by considering the transfer of surplus votes in an STV election. In 1991, candidate Alice Wolf was elected with almost twice as many #1 choices as were required by quota. Thus, nearly 2,000 extra ballots were to be transferred to other candidates.

According to the first interpretation of an ordinal ballot, we are to assume that the 2,000 voters whose ballots are to be transferred no longer wish to be represented by Alice Wolf because she does not require their support. This interpretation is inaccurate. Obviously, the 2,000 voters whose ballots are to be transferred were delighted with Wolf's success. They would certainly consider themselves represented by Wolf, but since she has been elected, they would like to try and elect another representative to an additional seat. The act of transferring a ballot in surplus does not imply that the voter is renouncing support for their first choice candidate.

The same interpretation holds true for the transfer of ballots from defeated candidates. If the second, third or fourth, etc. choice on a defeated candidate's ballots are passed over because they have already been elected, we cannot assume that the voter wishes to renounce the representativeness of those candidates. Indeed, she would be delighted that so many of her other top priorities have been elected. At the end of the election, this voter would not feel that she is represented solely by the candidate that ended up with her ballot. Rather, she would feel represented by all the candidates she listed on her ballot based on the order she expressed.

Thus, the second interpretation of ordinal ballots presented is more appropriate than the first interpretation. The fact that priorities must be expressed and that only one candidate can be awarded a ballot at one time does not mean we can assume categorical transfer of support in ordinal ballot elections. Only categorical systems require voters to designate a single champion. Ordinal systems ask voters to assemble a team, (or slate) of champions. The voter expresses some level of support for the entire team, even though she will prefer certain team members over others.

### *Summary:*

This chapter examines the differences between categorical and ordinal ballots. Plurality and list PR systems are categorical ballot systems. STV is an ordinal ballot system. This critical difference must be taken into account when comparing election systems. Indeed, the fact that STV is an ordinal system introduces an entirely different set of operational circumstances relative to list PR or plurality elections. These circumstances will be examined in more detail in future sections. For now, it is important to understand that the differences created by different ballot types make it impossible to apply the same assumptions to different PR systems. List PR and STV look similar compared with plurality when examining the mechanisms for allocating seats. Conversely, list PR and plurality look similar compared with STV when examining the method used to record each voter's wishes.

This chapter also examines the circumstances of voter behavior in ordinal ballot elections and the way in which ordinal ballots interpret the wishes of each voter. I used the economic theory of diminishing marginal utility to show how marginal voter utility falls as ordinal ballot lists get longer. This results in increasing levels of arbitrary choices as the listing process progresses. The exception to this rule is the extremely careful voter who increases marginal utility by using arbitrary choices to distance least preferred candidates from most preferred candidates.

The chapter closes by questioning the traditional assumption made by proportionalists regarding ordinal ballots in STV elections. Although votes are only awarded to one candidate at any one time, we have seen that voters typically consider the election of a team of representatives in ordinal elections allocating more than a single seat. Since it is not reasonable to assume that a voter will renounce the representativeness of a candidate that does not require her ballot, it can only be assumed that a voter lists candidates in an order that represents priorities for allocating all available seats.

### *Conclusion:*

The most important conclusion of this chapter is that list PR and STV use very different criteria for interpreting the wishes of voters. These differences are created by the type of ballot each PR system uses. The categorical ballot used in list PR assumes that each voter will express the same level of utility. Since voters are limited to supporting a single category of either candidate or party, all ballots have an absolute utility value of one. The decision factor of each voter is limited to choosing the category in which to place their allotted utility value of one. Once all the votes are cast, the only question remaining is how many absolute values of one does it take to equal an available seat. This question is the basis on which the quotas, most notable the Droop quota, have been proposed for list PR.

The ordinal ballot of STV adds another dimension to the decision factor of a voter. The uniform absolute utility of a categorical ballot becomes a variable with an ordinal ballot. The utility associated with an ordinal ballot is as varied as the values of each voter casting a ballot. Some ballots will contain more expression of representation than others, based on differences in individual voters. Moreover, the way in which values are expressed will also affect the value

associated with individual ballots. Because of this added dimension, it is impossible to assume that the effects of different quota definitions will be the same for list PR and STV. The effects of each quota formula must be defined independently for each PR system.

Since the categorical list PR system assumes each ballot has the same absolute value, the question of whether a change in the quota formula will favor one value system over another is moot. As far as a categorical system is concerned, there is only one value system. Therefore, it is impossible for a change in quota to change the how a categorical election system assigns value to one voter's utility relative to another voter's utility.

The added dimension of variable voter utility associated with an ordinal ballot dramatically changes the ability of different quotas to interpret voter utility. The voter utility expressed on an ordinal ballot can range from no preference to intricate degrees of preference for all candidates running. It is impossible for an ordinal ballot to express an absolute value of utility for any given ballot. Therefore, it is equally impossible to assume that a change in quota will not change how a ordinal election system interprets the value of one voter's utility relative to another voter's utility. The question of appropriate quota in an ordinal election requires a much more sophisticated analysis compared to that of a categorical election. This analysis takes place in Chapter 8.

## **Chapter 6: How Social Factors Affect Ordinal Voting**

Chapter 5 states that quota definition may affect how ordinal voting systems interpret voter utility. Yet that hypothesis does not explain how different interpretations of voter utility created by different quota formulas may be biased in one direction or another. If a voter's expression of utility in an ordinal system is based on entirely random criteria, it is possible to assume that different quota formulas will create no bias at all.

A categorical ballot system is an example of random expression of voter utility. Regardless of each voter's decision process, a categorical ballot system randomly assigns every ballot a uniform absolute value of one. Although an ordinal system does not randomly assign uniform absolute values, the same effect would be present if voters expressed different values in an entirely random fashion. If the utility expressed by voters is based on entirely random criteria, no single voter, or group of voters, can be said to hold a distinct, predictable advantage in an ordinal election. Even if the interpretation of voter utility in an ordinal election was changed by each quota formula, the random expression of voter utility would cancel out the chance of bias.

Chapter 6 examines how social factors affect ordinal voting and applies widely accepted sociological evidence to demonstrate that the expression of voter utility in an ordinal election is not based on random criteria. Rather, conditions associated with socio-economic status (hereafter referred to simply as status) have a predictable effect on the expression of voter utility in an ordinal election. Specifically, this chapter will address two issues of influence related to status.

First, it will examine how status affects the efficiency of utility expressed by individual voters and constituencies of voters in an ordinal election. The evidence to be presented strongly suggests that higher status leads to a higher level of voter utility in each individual voter. This evidence supports the hypothesis that higher status increases an individual voter's capability to cast a more expressive ordinal ballot, relative to a voter of lower status. In addition, this chapter will use sociological evidence to explain the role of efficiency in ordinal voting and how the benefits of efficiency increase with status.

Second, this chapter will show how status affects the ability of voting blocs to efficiently transform voter utility into electoral power in an ordinal election. The evidence to be presented strongly suggests that higher status predisposes a greater ability for voters to coalesce expressions of voter utility into common political gain in an ordinal election.

### ***Defining Efficiency:***

A considerable amount of research shows that political participation is strongly affected by status. Persons of high status, particularly in regard to educational attainment, are much more likely to take an active role in the political process (Milbrath, 1965; Parsons, 1969; Verba and Nie, 1972). In fact, the positive relationship between status and political participation is so strong, it is often called the "standard socio-economic model" (Berry, Portney, Thomson, 1993, p. 81).

Research also shows that the more intensive the type of political activity, the more likely it is that only higher status persons will participate. Persons of higher status have relatively more access to resources, more community connections, better developed communication networks and a stronger sense of ability than persons of lower status (Curtis & Jackson, 1977; Parsons, 1969). Thus, the more intensive the activity a political system demands, the more likely it is that higher status constituencies will dominate the proceedings (Berry et al. p. 74).

I will refer to the effect of these (and other social factors to be discussed later) as efficiency of voter utility. Efficiency of voter utility in this context is a measure of the proportion of potential voter utility actually expressed in an election. Any constituency has a latent potential for the expression of utility in an election. What proportion of this latent potential is expressed in the election constitutes the level of efficiency. If a constituency is able to express a large proportion of its potential voter utility, it is highly efficient.

There are three criteria that, in sum, define the level of efficiency in a given constituency.

- ◆ Percentage of Voter Turn-Out
- ◆ Level of Unification in the Expression of Utility
- ◆ Individual Level of Utility Expressed

The first criteria is the percentage of voters from a given constituency that actually show up to vote on election day. The larger the proportion of people that actually show up, the more utility will be expressed.

The second criteria is the ability of a given constituency to direct the total utility expressed towards a unified political goal such as the election of a given representative or slate of representatives. The ability to focus the collective utility of a constituency's voters increases the ability of the constituency to elect representation and to keep that representation accountable to their interests.

The third criteria of efficiency is the most important. It highlights the critical difference between ordinal and categorical ballot systems and has a dramatic impact on the first two criteria of efficiency. The third criteria of efficiency is the ability of each individual voter to maximize his or her individual expression of voter utility.

This third criteria of efficiency not a factor in categorical ballot systems because it is held constant for all voters. As stated in Chapter 5, categorical systems assign each ballot a uniform absolute utility value of one. Expanding on this idea, assume that a categorical system allocates utility within a range that has only two discrete points. Voters that do not show up on election day are assigned a utility value of zero while voters that do show up are assigned a utility value of one.

Ordinal ballots allow a variable expression of voter utility. Like categorical ballots, the range remains zero and one. However, the expressions of utility are not limited to these two

discrete points. Rather, ordinal ballots allow voter utility to be expressed as a continuous variable between the limits of zero and one.

For example, a voter that does not show up in an ordinal election still has a utility value of zero. Similarly, a voter can theoretically (depending on the total number of choices and the order in which the choices are expressed) express a perfect utility value of one. Most often, voters in an ordinal election will fall between these two points. Voters of low utility will have values closer to the lower limit of zero. Voters of high utility will have values closer to the upper limit of one.

Introducing the possibility of variable utility greatly affects the efficiency of a given constituency. For example, assume that two constituencies have the same proportion of voter turn-out in a given election (criteria one). In addition, assume that the two constituencies are also equally unified in their expression of support for a particular agenda (criteria two). In a categorical election these constituencies will have equal efficiency ratings because the utility expressed by each individual voter (criteria three) is uniformly assigned a utility value of one.

Applying the same assumptions to an ordinal election is likely to produce a very different result. Assume that criteria one and criteria two remain the same. Because ordinal elections allow variable expressions of voter utility, the values expressed in criteria three are likely to change dramatically. If the voters in Constituency A express lower levels of utility than voters in the voters in Constituency B, they will have a much lower level of total efficiency.

Indeed, assume that each voter in Constituency A expresses a utility value of .5 while the voters of Constituency B maintain a utility value of 1. Although the two constituencies have the same level of efficiency in terms of criteria one and criteria two, criteria three doubles the level of efficiency enjoyed by Constituency B, relative to Constituency A. After all three factors are combined into one measure of efficiency, the voters of Constituency A are only half as efficient in their expression of utility as the voters in Constituency B. In this case, Constituency A must double their turn out rate, in order to match the efficiency of voter utility expressed by Constituency B.

The democratic ideal of one person, one vote is greatly expanded in an ordinal election. The added dimension of variable utility changes this ideal to one person, one vote, many expressions. How many expressions, and in what order they are expressed, are greatly affected by factors of status. Consequently, efficiency of voter utility in an ordinal election is greatly affected by factors of status. In order to demonstrate the affect of status on efficiency, I will consider the three criteria of efficiency separately.

### *The First Criteria of Efficiency:*

The first criteria of efficiency is the proportion of voters from a given constituency that turn out for the election. Since higher status is strongly correlated with increased participation, I could assume that higher status constituencies would have a higher efficiency rating in this criteria. Yet, many studies assert that simply showing up to vote is such a low level of political participation that it is unlikely to be dramatically influenced by status ( Berry et al., 1991; Verba &

Nie, 1972; Dahl, 1961). Indeed, history shows that lower status communities have often had enormous success in get out the vote drives. It is not clear that higher status is an advantage in criteria one.

### *The Second Criteria of Efficiency:*

The second criteria of efficiency is the level of unification in a constituency's total expression of utility. If a constituency is solidly behind one candidate or group of candidates, it is much more efficient about its expression of utility. Utility is not wasted by having it spread out among a diffuse array of interests.

In a categorical election, the unification of a constituency's total expression of utility generally means that all members of that constituency will put their support into the same category (i.e., they will all vote for the same candidate or group of candidates). In an ordinal election, unification of a constituency's total expression of utility means that all members of that constituency will agree to list a specific slate of candidates for election.

As stated earlier, persons of higher status have relatively more access to resources, more community connections, better developed communication networks and a stronger sense of ability than persons of lower status. I can assume that higher status increases the ability of a constituency to organize and disseminate a proposal for a unified expression of voter utility.

In addition, voters of higher status, particularly in terms of higher educational attainment, are much more likely to receive, and be cognizant of, complex political messages (Milbrath, 1965). I can assume that individuals of higher status will be more receptive to a proposal for organizing a unified expression of voter utility.

However, it is also true that higher status, particularly in terms of educational attainment, leads to increased political sophistication (Milbrath, 1965). One could argue that, while increased status increases cognizance of political messages, it also may decrease the ability of higher status constituencies to reach consensus on a unified expression of voter utility. Increased political sophistication could result in more disagreements over what constitutes appropriate policy or representation, thus reducing the ability of higher status constituencies to increase efficiency through a more unified expression of voter utility.

While certain attributes of higher status increase the unity of voter utility expression, other factors of higher status decrease the unity of voter utility expression. A relationship of checks and balances works to nullify the effects of higher status on the ability to increase efficiency through greater unity of utility expression. However, this phenomenon does not apply equally to categorical and ordinal election systems.

The increased political sophistication commonly associated with increased educational attainment creates much more conflict in a categorical voting system than in an ordinal voting system. Assume a constituency of high status was seeking to support the election of representatives to five seats. In a categorical system, increased political sophistication is likely to

produce more dissent than consensus. They cannot endorse more than five candidates because they risk splitting their votes into small, unsuccessful pluralities.\*

In an ordinal election, the effect of increased political sophistication is more likely to create consensus than dissent. Since the individual transfer of ballots removes the risk of splitting the vote, there is much less motivation to limit the number of candidates endorsed to represent a given constituency. Voters do not have to reconcile differences into a single monolithic category in order to gain the efficiency of uniformity. The preferencing process of ordinal voting allows members of a constituency to express differences in priority without sacrificing the efficiency of uniformity.

Categorical systems create a zero-sum condition for uniformity. After a certain point, increasing support for one priority will always precipitate a decrease in support for another priority, given a finite number of constituency members. This creates the incentive for competition and dissent as status increases. Ordinal ballots allow a positive-sum condition for uniformity. Preferencing allows new priorities to be added and supported without necessarily resulting in a loss of support to other priorities.

The checks and balances that normally nullify the advantage of higher status in the uniform presentation of voter utility do not apply in an ordinal system. Increased political sophistication in an ordinal system creates a positive increase in the ability of a constituency to organize and disseminate a proposal for a uniform expression of voter utility. Thus, higher status constituencies are expected to enjoy the advantage of higher efficiency in the uniform presentation of voter utility in ordinal elections. Higher status produces more efficiency in criteria two. The concept of nullifying the checks and balances of higher status in an ordinal system are also addressed from an individual voter perspective later in this chapter in the subsection entitled *The Complementary Nature of Personal Representation and Political Expedience in Ordinal Systems*.

### ***The Third Criteria of Efficiency:***

The third criteria of efficiency is the ability of each individual voter to maximize his or her individual expression of voter utility. This is the most critical factor in an ordinal election. How people perceive themselves as part of a constituency and community has a significant effect on the amount of utility they are likely to express as voters. Sociological evidence indicates that persons of high status are more likely to express higher levels of voter utility than persons of lower status. The next seven subsections of this chapter will present a model for explaining how status affects the amount of voter utility expressed by an individual.

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\* This would not happen in list system elections. However, since the list system gives high priority of election to candidates placed high on the list, it is fair to assume that increased political sophistication would foster more debate over the order in which candidates would be listed on the list PR ballot. Persons of higher sophistication that are dissatisfied with the listing order may give their support to a different list, thus splitting the vote of the constituency and weakening the efficiency associated with uniform expression of voter utility.

### ***Political Efficacy and Status:***

Political efficacy is a term that describes how each person views his or her role in the political process. A high rate of efficacy means that a person feels empowered as a participant in the political process and gains a significant amount of satisfaction from this activity. Conversely, a low rate of efficacy means that a person feels powerless in the political process and seeks to avoid political activity.

Berry et al. (1991) identify two different types of political efficacy which they call internal and external political efficacy. Internal efficacy is an individual's sense that he or she is capable of understanding the political process. In a survey of 15 cities they asked people to agree or disagree with the statement "sometimes politics and government seem so complicated that a person like me can't really understand what's going on". Agreement or disagreement to this statement was used as a measure of internal efficacy. External efficacy is an individual's sense that government will be responsive to his or her influence. In the same survey, Berry et. al. asked people to agree or disagree with the statement "people like me don't have any say about what government does." Responses to this statement were used as a measure of external efficacy (p. 261).

The survey by Berry et al. controlled for status and level of participation in community activities. The results show that internal and external efficacy are significantly higher in high status persons than in lower status persons, regardless of each respondent's particular level of participation (p. 265).

Why do people of higher status have significantly higher ratings of efficacy than people of low status? Educational attainment seems to be the most important factor. As stated earlier, increased educational attainment is strongly correlated with higher status. In addition, a substantial body of research shows educational attainment is also independently correlated with increased efficacy and increased political participation (Curtis & Jackson, 1977; Milbrath, 1965).

In addition, Berry et al. (1991) have shown that there is strong evidence of "reciprocal causality" in the relationship between efficacy and participation. Stated simply, reciprocal causality means that participation increases efficacy while increased efficacy leads to more participation. Thus, a cycle of increased participation and increased efficacy is established. Since educational attainment is strongly correlated with both efficacy and participation, it acts as the catalyst for setting off the ever increasing reciprocal causality of efficacy and political participation. Thus, educational attainment remains a central indicator for status, efficacy, and political participation (p. 265).

### ***Tolerance and Status:***

Tolerance is an extremely important factor when considering the effects of status on an individual's expression voter utility. Tolerance as it relates to representation describes that willingness of a person to recognize the validity of differences among potential choices. Differences can be ideological, racial or ethnic. They can be based on gender or sexual orientation, social class, where a person lives, or where they were brought up, etc. It would be

impossible to list all of the cultural characteristics that create differences between individuals or groups of people. Yet, voters must measure and balance, whether deliberate or not, their tolerance for all the characteristics that make up each candidate in an election.

Similar to status, efficacy, and participation, tolerance is strongly correlated with higher educational attainment (Nunn, 1978). Indeed, the advent of public opinion polls showed a disturbing difference in the tolerance levels expressed by the well educated and the less educated general public. This prompted a school of thought that proposed representation by elites as the only way to ensure that democratic government would function successfully. Virtually all people would agree that tolerance is critically important to democracy. Since the well educated express significantly more tolerance than the less educated general public, government by elites seemed to be critical to democracy (Dahl, 1956; Dye and Zeigler, 1978 in Berry p. 217).

More recent research has proven this school of thought to be over simplified. Along with educational attainment and status, tolerance is also affected by political efficacy and, consequently, political participation (Berry et al., p. 221). The higher the rate of efficacy, the higher the level of tolerance. How confident people feel about their own views, and how those views may affect government will certainly have a dramatic effect on tolerance. If a people are very self-assured and confident of their place in a community, they are less likely to feel threatened by differences. Thus, people are more likely to tolerate differences among associates or candidates.

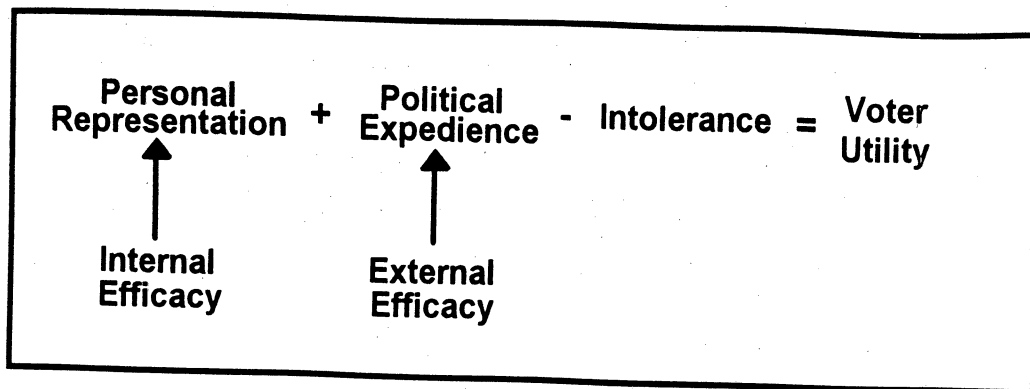
#### ***How Tolerance , Efficacy, and Participation Affect Ordinal Voting Behavior:***

Thus far, I have shown that factors associated with high status have a strong effect on political behavior. Specifically, educational attainment is proven to independently increase political participation, tolerance, and efficacy. Similarly, research has shown a reciprocally positive relationship between political participation and tolerance. There is also evidence to support a positive relationship between tolerance and efficacy (Berry, p. 226). However, it is not necessary to examine the specific correlates and causal paths of these factors in order to conclude that these factors catalyze and re-enforce each other at an increasing rate as status increases. This is true regardless of the political system.

As stated before, ordinal systems allow each voter to decide a certain level of voter utility for each candidate in the election. Tolerance and efficacy, along with status and participation, play a significant role in determining the total voter utility to be allocated to a list of candidates. Consequently, they also affect the point at which voter utility becomes exhausted. Quite simply, tolerance, efficacy, and participation affect how many candidates are likely to be listed on a ballot. Since these factors are strongly influenced by a voter's educational attainment, we can expect that there is a direct relationship between educational attainment and the number of candidates listed on an ordinal ballot.

Figure 6.1 shows the process for determining the voter utility of an individual voter in an ordinal election. Each aspect of the diagram is explained below.

Figure 6.1 Effect of Efficacy on Voter Utility



***Personal Representation:***

Personal representation is simply the degree to which the voter identifies with a particular candidate or group of candidates. A voter may identify with a candidate based on issue positions or may share the same ethnic background, neighborhood, experiences, or some other perspective.

As shown in figure 6.1, personal representation is affected by the voter's internal efficacy. The higher the level of internal efficacy, the more the voter will be aware of the candidates running in the election. With a high internal efficacy level, voters feel that their considerations have value. Thus, they will allocate their support as effectively as possible by seeking the highest return of voter utility from their list. Their preferences will be strategically allocated to the maximum number of candidates able to provide a positive net return of representation. High internal efficacy sharpens the preferencing process and reduces the number of ambiguous candidates encountered by a voter. Consequently, high internal efficacy produces longer lists of potential representative preferences because it produces a relatively sophisticated conception of appropriate representation.

Low internal efficacy affects personal representation in the opposite manner. Voters with low internal efficacy question their importance in an election. They do not gain a significant level of satisfaction from supporting appropriate candidates because they do not feel that the representation will benefit their interests. Voters with low internal efficacy are less likely to actively seek the highest possible return of voter utility. In addition, the number of characteristics capable of providing a positive return of voter utility are relatively limited for low internal efficacy voters. Thus, the low internal efficacy voter is likely to use a smaller number of very basic criteria to list candidates in an ordinal election. Marginal voter utility falls off rapidly after the initial choices and preferencing ends relatively quickly. Consequently, low internal efficacy produces shorter lists of potential representation based on a relatively simple conception of appropriate representation.

***Political Expedience:***

Political expedience represents the propensity as well as the ability of a individual voter to coalesce his or her interests with other voters in order to produce mutual gain. While political

expedience is part of any election system, it plays a significantly more important role in ordinal elections. In categorical systems, political expedience usually conflicts with personal representation. An example of this conflict is strategic voting. As discussed earlier, strategic voting takes place when voters forgo their the most representative candidates (personal representation) for one more likely to win (politically expedient).

Political expedience is a complementary force to personal representation in ordinal election systems. As stated earlier, ordinal ballots "allow voters to represent their least powerful positive feelings in small parcels of support for each of several parties (or candidates)." The absence of categorical limitations that secure vote strength to one designee introduces the possibility of inefficiency to the election system. Political expedience in ordinal voting systems seeks to compliment personal representation by ensuring the highest possible level of efficiency in the expression of preferences. It is where outside political factors such as the coalition or opposition of other voters affect the preferencing process of an individual voter in an ordinal election.

Political expedience is not simply the function of a political party. It is the catalyst that motivates individuals to form and utilize a political party. More importantly, political expedience is the force that motivates individual voters to accept and support political party platforms and slates.

As shown in figure 6.1, political expedience is affected by the voter's external efficacy. The higher the level of external efficacy, the more the voter believes that representatives will be responsive to his or her interests. With a high external efficacy level, a person feels that she has the ability and indeed, the obligation to craft associations between candidates in order to achieve efficiency. In an ordinal voting system high external efficacy motivates voters to organize candidates into efficient groupings. Higher external efficacy provides voters with the confidence and ability to negotiate efficient, and consequently expedient, groupings of candidates.

Low external efficacy affects political expedience in the opposite manner. The lower the level of external efficacy, the less likely it is that voters will see themselves as authority figures. Thus, lower external efficacy increases the perception that options are limited to acceptance or rejection of a particular candidate. Lower external efficacy voters do not feel they have the power to influence and modify candidate groupings in order to increase efficiency. Indeed, extremely low external efficacy precludes an understanding of the role of efficiency in an ordinal voting system.

The effects of lower external efficacy are not limited to inhibiting the motivation needed to create efficient candidate groupings. Lower external efficacy also inhibits the acceptance of efficient groupings offered by more expedient constituencies. Since lower external efficacy voters are more inclined to accept or reject individual candidates rather than reward compromise, candidates with a narrow, more focused agenda are more likely to be considered representative than candidates with a compromised agenda. Thus, candidate competition increases in appeal to lower efficacy voters. The lower the external efficacy of the voter, the more incentive for candidates to abandon a politically expedient association.

### ***Tolerance:***

When a voter is deciding how to produce a list of candidates in an ordinal election, the absence of tolerance acts as a limiting factor to the level of political expediency. Thus, figure 6.1 shows intolerance being subtracted from political expedience. The more tolerant a voter is, the more likely that he or she will be politically expedient. The less tolerant a voter is, the less likely it is that he will be politically expedient. Voters with a high degree of tolerance are more capable of listing a wider array of candidates. Thus, they have a greater ability to craft (and accept) politically expedient associations. Voters who have a low level of tolerance have much more rigid criteria for selecting politically expedient candidates. Thus, the lower the tolerance level, the harder it is to assemble a politically expedient slate of candidates.

Tolerance is greatly affected by external efficacy. High external efficacy will produce a high level of tolerance while lower external efficacy will produce a low level of tolerance. The issue is basically one of security. High external efficacy voters are confident of their ability to make representatives respond to their interests. Thus, they are more likely to ignore characteristics that they find intolerable in order to gain political expedience. High external efficacy voters view being tolerant as a way to gain power for themselves.

Low level external efficacy voters are much less secure about their relationship to representatives. They view representatives as authority figures and will find intolerable characteristics harder to ignore. They do not wish to be controlled by someone who exhibits characteristics which are perceived as unrepresentative or threatening. Low external efficacy voters view tolerance as a way of placing themselves under the control of unrepresentative leaders.

### ***A Very Important Note on Tolerance:***

Tolerance in the context used here is an objective criteria. Thus, it should not be considered good or bad, desirable or undesirable. Of course, we are taught that tolerance should be rewarded and that intolerance is synonymous with racism, sexism, homophobia and other social ills that threaten a free society.

However, tolerance does not imply acceptance. Thus, a very tolerant person can be just as racist, sexist, or homophobic as a very intolerant person. The issue is one of security. A person who perceives herself with a high degree of power (high external efficacy) although perhaps a racist, is more likely to tolerate candidates of different races because she feels capable of controlling or subjugating that candidate to her interests. In many cases, tolerance is only used as a control strategy, and is not related to acceptance.

Tolerance, as it is used in this model, is not limited to highly charged social issues. Tolerance can also refer to something as socially benign as geography. Again, the issue is one of security and external efficacy. People with low external efficacy are less likely to be tolerant of a candidate who does not live in their neighborhood. For example, regardless of the candidate's other attributes, people may fear placing power in the hands of someone who does not know their

neighborhood. They draw security from proximity and value having a person of authority close at hand. Thus, a candidate from a different area is harder to tolerate.

Conversely, people with high external efficacy are more likely to be tolerant of geographic differences. They already have a feeling of power and security and, thus, do not value close proximity as much as other attributes. High external efficacy people feel that they have the power to maintain the accountability of their representatives. They make the decisions regarding their neighborhood while a representative should only be concerned with carrying out their wishes. Thus, a candidate from a different area is easier to tolerate.

### ***The Complementary Nature of Personal Representation and Political Expedience in Ordinal Systems:***

The fact that personal representation and political expedience are opposing forces in categorical systems but complementary forces in ordinal systems is extremely significant. As stated earlier, the key to understanding the opposing vs. complementary concept is in the ability of ordinal systems to "allow voters to represent their least powerful positive feelings in small parcels of support for each of several parties (or candidates)."

An increase in internal efficacy leads to an increasingly sophisticated perception of appropriate personal representation. When a voter is limited to an absolute categorical choice, it is more difficult to address the needs of increasingly sophisticated criteria. With the demands of a more sophisticated constituency, it becomes difficult to reconcile all of the requirements expressed into one categorical choice that the entire constituency will efficiently and effectively support.

Conversely, lower internal efficacy leads to a less sophisticated perception of appropriate representation. Voters are less likely to be aware of and, consequently, critical of fine points of a candidate's representation, provided that the candidate satisfies relatively basic requirements of representation. Thus, a less sophisticated perception of personal representation allows for the creation of broader support in categorical systems.

An increasingly sophisticated perception of personal representation becomes a disincentive for a voter to participate in politically expedient support in categorical elections. It is often said that successful candidates in categorical elections must "walk a tightrope" between the needs of different factions that make up their support base. As internal efficacy increases sophistication, the tightrope becomes thinner and thinner, making it increasingly difficult for a candidate to hold a coalition of voters together.

Clearly, personal representation and political expediency, as they relate to status, have an inverse relationship in categorical elections. The inverse nature of this relationship counteracts many of the other advantages of higher status voters. For example, while ability to communicate rises in higher status constituencies, the ability to reach consensus on one candidate falls. Similarly, while overall participation in the political process increases as status increases, the ability to efficiently channel that participation toward a common goal decreases.

The opposite is true of ordinal elections, where personal representation and political expediency have a complementary relationship. Because ordinal voting does not require voters to sum up their support in a single category, the competition between sophisticated interests is eliminated. As stated before, an increasingly sophisticated perception of personal representation makes it difficult for one candidate, or even a few candidates, to meet all the requirements of a voter. Since ordinal voting does not force voters to support certain candidates at the expense of other candidates, an increasingly sophisticated perception of personal representation is likely to produce a wider variety of candidates capable of providing some measure of representation (utility) to voters.

Since an increasingly sophisticated perception of personal representation increases the number of candidates likely to be approved of, at least in some measure, by a particular voter, the more likely it is that voters will be able to coalesce efficiently. Increasingly sophisticated perceptions of personal representation only affect the order in which a voter will list candidates on an ordinal ballot. It does not inhibit the ability of political organizations to create a list of acceptable candidate associations, provided they do not attempt to define the specific order of preference for the chosen list. Therefore, personal representation and political expedience, as they relate to status, are complementary forces to a voter in an ordinal election system.

Because personal representation and political expedience are complementary forces in ordinal systems, the advantages of higher status are increased. For example, as the ability to communicate effectively rises in higher status constituencies, the likelihood that the message will be accepted by an individual voter also increases. Similarly, as overall participation in the political process increases with status, the willingness to efficiently channel that participation toward a common goal increases.

### *Classism and Ordinal Voting:*

The concept of classism suggests that higher status persons retain a prejudice against persons of lower status. Moreover, it is quite reasonable to assume that classism will manifest itself in a situation that deals so directly with appropriate representation.

Stated simply, it is likely that as the status of voters increases, the change will result in a decrease in the ability of lower status candidates to be considered acceptable representation. For example, a candidate that has a high school education is less likely to be considered appropriate representation by constituencies of higher educational attainment. The manifestation of classism based on educational attainment is valid since status and educational attainment are closely correlated.

The evidence of classism in ordinal voting is inherent in the previous discussion of internal efficacy and the perception of appropriate representation. As internal efficacy rises with status, perceptions of appropriate personal representation become more sophisticated. It is likely that this increased sophistication will require candidates to hold significant credentials to prove their ability to meet the requirements of more sophisticated expectations. Credentials are likely to include college and advanced professional degrees and/or a prior record of prestige in business or

government. Moreover, it is likely that higher status voters will expect representatives to have credentials that equal or exceed their own. Thus, the more status increases among voters, the more discriminating they are likely to be about credentials for representation.

Classism manifests itself among lower status voters as well, although the motivations are entirely different than those of upper status constituencies. Since internal efficacy falls with status, lower status persons are more likely to have an authoritarian perception of appropriate personal representation. They may possess a greater tendency to vote for representatives that already maintain a recognizable level of credentials, prestige and authority. Lower status voters are more likely to be influenced by a perception that a candidate has the power and capacity to "deliver the goods" in terms of representing their interests. They are electing spokespersons or champions as opposed to servants, and they want their champions to be well equipped. Lower status persons also require appropriate personal representation to have credentials that equal or exceed their own. This is a manifestation of classism.

Classism is a limiting factor for listing appropriate personal representation regardless of status. However, the higher the status, (and consequent internal efficacy) the more exclusive the effects of classism. Although all voters, regardless of status, are likely to demand equal or higher prestige of their representatives, virtually all candidates will meet the classism criteria of the lowest status voters while fewer of the candidates will meet the classism criteria of the highest status voters. Consequently, we can expect the effects of classism to become stronger as status rises.

### *The Product of the Process:*

As Figure 6.1 shows, the product of this process is the total voter utility expressed by each voter. The candidate who produces the highest expression of voter utility will be listed first. Other candidates will be listed in order of the voter utility they produce for the voter. Thus, the amount of voter utility returned by each successive candidate listed diminishes, as explained in Chapter 5. Based on the law of diminishing marginal utility, a voter will continue to list candidates until the amount of utility produced by listing a candidate reaches zero.

Clearly, there is an important role for efficacy in this model. Increased internal efficacy produces a higher expression of voter utility from the process of evaluating candidates based on personal representation criteria. Similarly, increased external efficacy produces higher expression of voter utility from the process of evaluating candidates based on the political expediency criteria.

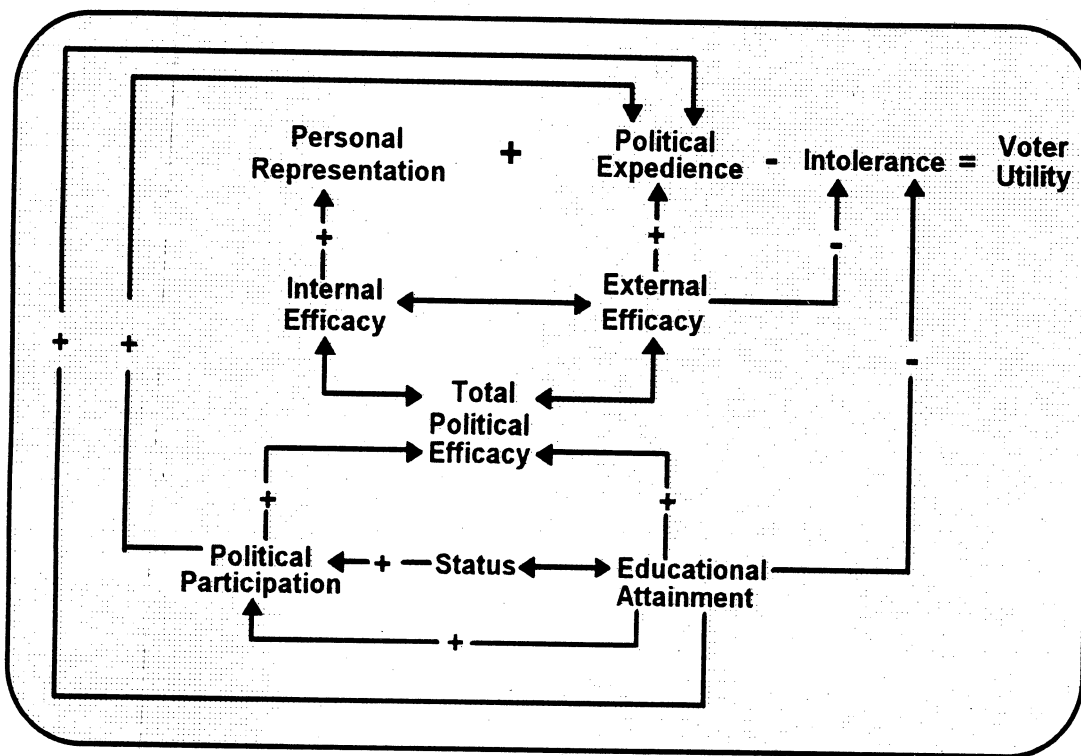
There is also an important role for tolerance in this model. Intolerance subtracts from the utility of political expedience because the less tolerant a voter is, the less likely he or she is to act in a politically expedient manner. Since external efficacy affects the level of tolerance a voter will express, it therefore plays a dual role in effecting the expression of voter utility. Increased external efficacy increases the utility produced by political expediency, however it also decreases the utility subtracted from political expedience by reducing the effect of intolerance on the ability

to act expediently. Thus, the sum effect of increased external efficacy is a dramatic increase in the ability of a voter to act in a politically expedient manner.

The dual effects of external efficacy on the ability of a voter to increase the amount of voter utility received from political expediency is the principal reason why upper status voters are more likely to accept and support the strategic selections promoted by political organizations. Since upper status voters have a higher rate of external efficacy, they are more willing to seek out and coalesce around a politically expedient association of candidates. Similarly, since increased external efficacy (and corresponding higher status) decreases the amount of intolerance expressed by voters, it become more likely that higher status voters will be more capable of accepting a politically expedient association of candidates presented by a political organization. In other words, high status voters are more likely to initiate coalitions and accept them as appropriate representation.

Figure 6.2 shows the full effect of social factors on the ordinal voting process by expanding the presentation of figure 6.1.

Figure 6.2 Effect of Social Factors on Ordinal Voting



The direction of the arrows show the path of effect for each of the factors included in this model. Paths that have arrows in two directions represent the reciprocal relationship between those two factors. For example, status has an effect on political participation, but there is no clear evidence to suggest that political participation has an effect on status. Conversely, status has an effect on educational attainment, but educational attainment also contributes to increased status. Therefore, the model shows arrows in both directions between these two factors. Moreover,

reciprocal relationships in this model are all positive, meaning that an increase in one reciprocal factor always leads to an increase in the related reciprocal factor.

Relationships which are not reciprocal may be positively or negatively related. The sign presented in the path indicates the power of the relationship between the two factors being connected. For example, the model shows political participation has an effect on a voter's political expedience. The plus sign indicated that this is a positive relationship. Thus, an increase in political participation contributes to an increase in political expedience.

Conversely, the model shows that educational attainment and external efficacy both affect intolerance. A negative sign is inserted in these respective paths to indicate that an increase in educational attainment or external efficacy leads to a decrease of intolerance. Similarly, the effect of status on personal representation is also a negative relationship. This is due to the manifestation of classism. Since classism causes a voter to be less inclusive of candidates as status rises, the effect on personal representation is negative.

The model also shows efficacy and political participation to be reciprocally related to each other. While the testing done by Berry et al. indicated that internal and external efficacy are two separate factors, there is no evidence to suggest that they act independently of each other. In other words, there is no evidence to suggest how someone can have high internal efficacy and low external efficacy. Thus, this model also shows a reciprocal relationship between internal and external efficacy.

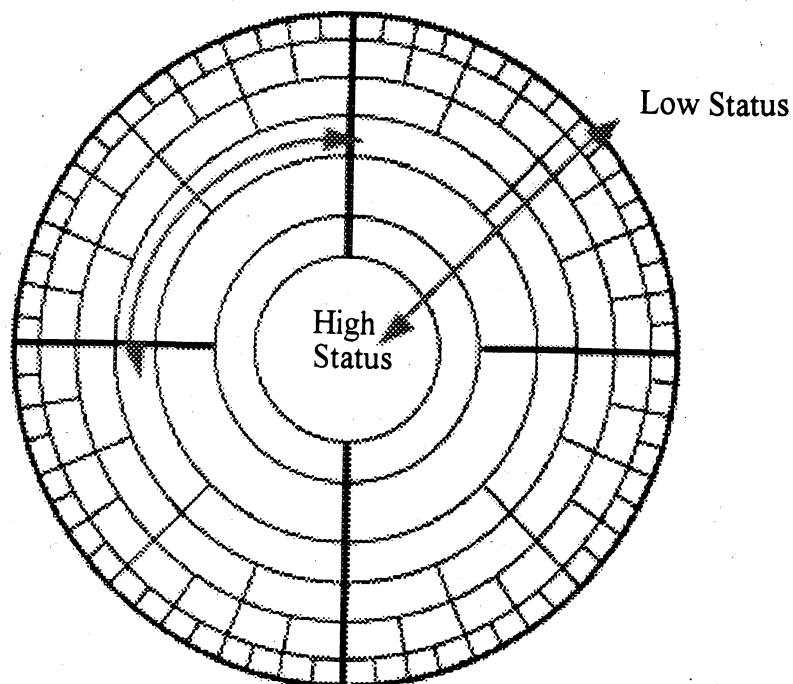
### ***The Aggregate Effect of Status and Efficiency in Ordinal Elections:***

Thus far, this chapter has outlined how the three criteria of efficiency are affected by status. In the first criteria there is no clear evidence that status has a positive effect on the ability of a constituency to increase its proportion of turn-out. In the second criteria, evidence suggests that higher status increases the ability of a constituency to create uniform expression of utility in ordinal elections. In criteria three, figure 7.2 shows how status affects the ability of an individual to express voter utility. This evidence suggests that individuals of higher status can express more voter utility because they have a perception of themselves, a perception of their role in a community and a perception of appropriate representation that is better suited to ordinal voting than persons of lower status.

The remainder of this chapter will address how the three factors of efficiency affect an ordinal election in the aggregate. It will explain how the advantages of status present in an ordinal election manifest themselves when constituencies of different status compete to elect representation. I have demonstrated that higher status increases the total amount of utility expressed by individuals, and the ability of those individuals to direct it toward unified goals of representation in an ordinal election. In other words, I have demonstrated that higher status improves the efficiency of voter utility in an ordinal election. The remainder of this chapter will explain how improved efficiency of voter utility increases the chances of electing representation.

The most appropriate way to plot the aggregate effects of status and efficiency is the central-peripheral dimension. By using a central-peripheral dimension, it is possible to demonstrate the relationship between voters of different status and thus, the effects of efficiency in an ordinal election in the aggregate. Figure 6.3 is a central-peripheral demonstration of status and efficiency in an ordinal election.

Figure 6.3



Aggregate Effects of Social Position on Ordinal Voting

***Explaining the Model:***

The premise of the central-peripheral dimension is a metaphor for society in general and therefore works well to demonstrate the effects of status in an election. The center of the model represents people of high status and all of the factors that are affected by high status. Thus, the closer one gets to the center of the model, the more status increases. Since educational attainment is closely related to status, educational attainment increases when moving closer to the center of the model. The same can be said for other correlates of status such as tolerance and internal efficacy.

The central-peripheral dimension also demonstrates group factors that are related to status, such as communication networks and political participation. As stated before, ability to communicate and level of political participation increases with status. Since external efficacy increases with status, it can also be said that people closer to the center feel more powerful than others and are perceived as being more powerful than others. Therefore, the center of the model represents people that are at the "center of things." Moving towards the center represents

increasing influence, power, resources, knowledge, ability and all the other social factors that affect, and are affected by, status.

Increased distance from the center corresponds to a decrease in status and all the factors associated with status. The farther out on the periphery of the model, the more marginal the influence, power, resources, knowledge, ability, etc. of voters. People on the outer edges of the model have very little influence on the community as a whole. They are the people of low status, efficacy, educational attainment, tolerance and participation.

Thus, movement across the model represents the intensity or power of social factors such as high or low status, high or low efficacy, high or low tolerance, high or low educational attainment. Referring back to Figure 6.2, movement across the model represents the magnitude of the positive, negative or reciprocal relationships between factors. Thus, voters in the center of the model will have much higher total voter utility than voters on the periphery of the model.

Movement around the model represents the different variables related to different social constituencies of voters. The simplest example of a social constituency is gender. We can say that one half of the model are women, the other half are men. Some men will be closer to the center than other men. Similarly, some women will be closer to the center than other women. Accounting for gender based discrimination in our society, we can also assume that more men than women will be closer to the center.

Of course, there are different types of men and women. Adding the variable of race and ethnicity for example, the array begins to spread out around the circumference of the model. The model remains half men, half women, but they are organized around the circumference based on race and ethnicity. Of course, people of some races and ethnicity will be closer to the center than people of other races and ethnicity. Moreover, the effects of race and ethnicity on position across the model are not independent of the effects of gender. Thus, people of the same race or ethnic background will be closer or further from the center, based on their gender.

The process continues through the endless number of factors that contribute to status in our society. The sum total of all these factors contributes to each individual's position on the central-peripheral model. Certainly, we cannot measure the value of each factor in a person and plot their definitive position on the model. However, we can make some assumptions based on well known sociological evidence. For example, it is generally accepted that being male is more advantageous than being female in our society. Similarly, being white is more advantageous than being non-white.

The advantages and disadvantages that characterize each individual contribute to each person's distance from the center as well as his or her place on the circumference of the model. Thus, a black male may be the same distance from the center as a white women assuming that the average of their social advantages and disadvantages are equal. However, they are very different individuals and will occupy different places along the circumference of the model.

Everyone has a place on the center-peripheral model depending on how the average of their social factors compares with the average of others. Some people will be closer to the center than others. In addition, people with a different combinations of social factors will be located along different sections of the circumference than others.

*Cambridge, 1991:*

Let's assume that the center-peripheral model represents the voters of the 1991 Cambridge City Council election. All 22,972 voters have some place on the model based on their status as dictated by their combination of social factors. Voters with social factors affording them higher status are closer to the center than voters with social factors that afford them lower status. Based on the processes each voter uses to list candidates on their ordinal ballot, it is possible to model the effects of status and efficiency on the total population of voters.

The critical question to be answered is this: how does status affect the efficient grouping and transfer of votes in the election? In other words, how does status affect the preference priorities expressed by voters. The arrows in the model indicate the two possible directions of vote transfer movement. First, transfer votes can move circumferentially around the model, moving from constituencies of one combination of social factors to another constituency of different social factors. For example, a voter that supported an Italian candidate from their neighborhood may have listed an Irish candidate from their neighborhood second. This would represent movement around the circumference of the model. Conversely, a voter may have voted for an Italian candidate from their neighborhood first, then another Italian candidate from a different neighborhood second. The change still represents circumferential movement, it just happens to be in a different direction.

Votes can also move across the model, moving closer to the center or further out on the periphery. For example, a lower status person may list a lower status candidate first and a higher status candidate second. This represents movement from the periphery towards the center. If a higher status person lists a higher status candidate first and a lower status candidate second, this represents movement from the center towards the periphery. Classism affects the movement of preferences across the model. Because voters are likely to expect appropriate representation to have equal or better status than themselves, preferences will tend to move from the periphery to the center rather than vice versa.

For example, assume a lower status person is in the voting booth. His first preference might be a lower status candidate that shares many of the same social characteristics and perspectives as himself. As his preferencing process continues, the remaining candidates will share fewer and fewer of his social characteristics and perspectives. His preferencing process will increasingly rely on the status of the remaining candidates. If he chooses to continue listing, he is likely to list candidates of higher status than candidates of lower status. The more status become a decision criteria in the preferencing process, the more classism provides an incentive to him to list candidates that he perceives to possess the connections, credentials and power to represent his interests. Thus, as his preferencing process moves around the model, it will also have a stronger tendency to move toward the center.

Classism has a much more dramatic effect on votes of higher status. For example, assume a higher status person is in the voting booth. Like her lower status counterpart, she will give her first list to a candidate that shares her social characteristics and perspectives. As her listing process continues, she too will be faced with listing candidates based more on her perception of their ability to represent her. The effect of classism dictates that she choose candidates that she perceives as having abilities or credentials that meet or exceed her own. Thus, she will choose candidates that are closer to the center of the model than she is, or she will stop listing candidates. It is unlikely that she will award specific preferences to remaining candidates that she feels are not qualified to represent her interests. In other words, it is unlikely that preferencing will move from the center to the periphery.

### *Differences in Efficiency Based on Status:*

The lines intersecting figure 6.3 at various angles are barriers to transferability that represent the relative differences in efficiency created by different status. In efficiency criteria two, higher status is shown to increase the propensity for uniform expression of voter utility. The increase in uniform expression of utility created by increasing status is represented by the reduction in barriers to transferability found closer to the center of the model.

In efficiency criteria three, higher status is shown to increase the ability of individual voters to express higher levels of voter utility. Higher levels of voter utility allows voters to list more candidates on their ballots (within the limits defined by classism and political expedience). The increase in the ability to list more candidates (voting deeper slates) is represented by the increasing size of each area that corresponds with movement toward the center of the model.

Voters in the very center of the model are extremely well suited to ordinal voting because they enjoy the maximum advantage of efficiency associated with increased status. There are no barriers to uniform expression of utility so these votes move without any encumbrances. In other words, votes from the constituency of the center (higher status) will be able to maximize the support given to candidates approved of by that constituency. The high rate of efficiency means that very few transfer votes will be wasted by becoming exhausted or by transferring to candidates not approved of by the constituency. The effects of classism will cause votes that originated in the center to stay concentrated in the center.

Voters in the next ring out from the center are at a lower status than voters in the very center. These voters will have a slightly less uniform expression of utility than the voters in the very center. In addition, they will express lower levels of voter utility, increasing the likelihood that they will express fewer preferences before their utility level reaches zero. In other words, they are likely to cast shorter ballots than voters in the very center.

This change is represented by the barrier to full circumferential movement. Although there is still a considerable degree of freedom, voters at this distance from the center do not have the same level of uniformity of expression or the same level of individual voter utility. The lower level of uniform expression of utility will result in more voters giving preferences to candidates not approved of by their constituency. Preferencing will be made on increasingly heterogeneous

priorities rather than on the more homogenous priorities of the very center. Voters will have a less uniform perception of the number of candidates to be listed. Thus, an increasing number of transfer votes can be expected to go to candidates from outside the constituency or to become exhausted. Fewer voters will adhere to listing a designated number of choices. Since individual voter utility decreases as status falls, more ballots are likely to list less than the designated uniform number of choices. Conversely, the effect of classism will push more votes to the center, with some voters listing more than the designated uniform number of choices. Overall, as status decreases, the uniformity of the number of choices expressed by a constituency will be much less efficient.

Moving out to the periphery where status is much lower, there are significant barriers to uniformity and much lower levels of voter utility. These constituencies can be expected to demonstrate increasingly heterogeneous voting behavior. The lower voter utility of lower status will increase the number of ballots listing fewer candidates than the designated uniform number. Conversely, classism will increasingly pull votes toward the center of the model, causing some voters to list more than the designated uniform number of candidates. Thus, the lower status constituencies will produce a distribution of choices far more heterogeneous than constituencies of higher status. A relatively higher number of transfer votes will go exhausted or will move toward the center. There will be little uniformity of transfer to a designated group of candidates. Lower status transfers will have a low level of efficiency.

### ***Conclusion:***

This chapter concentrates on the concept of efficiency in ordinal voting systems. Efficiency is defined by the amount of voter utility an individual can express, and the ability of a constituency to direct individual voter utility into a unified expression in the transfer process. This chapter used widely accepted sociological evidence to demonstrate how higher status voters and constituencies are capable of higher level of efficiency than lower status voters and constituencies.

This chapter also demonstrated how the differences in efficiency associated with status manifest themselves in an ordinal election. Figure 7.3 uses the central-peripheral dimension to show the relative differences in efficiency based on status. It explains how the lack of barriers in the center of the model (higher status) allows a higher percentage of transfer votes to work toward the unified goals of the constituency. Conversely, it shows how transfer votes in lower status constituencies contend with barriers associated with less uniformity and less voter utility. Transfer votes in these constituencies are more likely to become exhausted or to move toward the center. A much lower percentage of the transfer votes are likely to work towards the unified goals of the constituency.

Status has predictable effects on the preferencing and transfer process of an ordinal election. Higher status voters and constituencies are much more efficient than lower status constituencies. Thus, I conclude that the more an ordinal election relies on transfer votes, the more of an advantage it will award to higher status constituencies. Since higher status increases uniformity, more transfer votes will tend to create a higher concentration of votes in the center.

In addition, the more an ordinal election relies on transfer votes, the more it will require ballots to include a larger number of preferences. Lower status constituencies produce ballots with fewer preferences relative to their higher status counterparts. Thus, the more an ordinal election relies on the transfer votes, the more likely it is that exhausted ballots will come from lower status voters.

Social status clearly plays a role in ordinal elections. This is a belief that many people in Cambridge have held for years. However, some people insist that the reason why higher status persons are more efficient about ordinal voting is due to the fact that they understand the intricacies of the system better. Although perhaps a small part of the issue, it is an oversimplification of the effect of status. The value systems and perspectives associated with status are the reasons why higher status voters are more suited to ordinal voting.

## Chapter 7: Ordinal Voting Patterns in the 1991 Cambridge City Council Election

Chapter 6 explains how voters of different status create different lists in an ordinal ballot system. Chapter 7 will test the hypotheses of Chapter 6 by examining the ordinal ballots of the 1991 Cambridge City Council election. Based on the evidence presented in Chapter 6, we can expect changes in status to produce predictable effects on the voting patterns of different constituencies.

The 1991 election is uniquely suited to this case study. It was a relatively stable election, meaning that there were a limited number of outside factors capable of producing anomalous effects on the voting patterns. First, all nine City Councillors ran for re-election so there were no open seats. Second, all nine City Councillors were re-elected. In addition, there were no galvanizing referendum questions to exert influence on the voting patterns. Overall, the 1991 Cambridge City Council election represents a relatively uncluttered snapshot of ordinal voting patterns.

The 1991 Cambridge City Council election also corresponds closely to the 1990 US census. Information from the 1990 census will be used to define the status of different constituencies in the 1991 election. In this manner, I will compare the results of two different snapshots of Cambridge taken at relatively the same time.

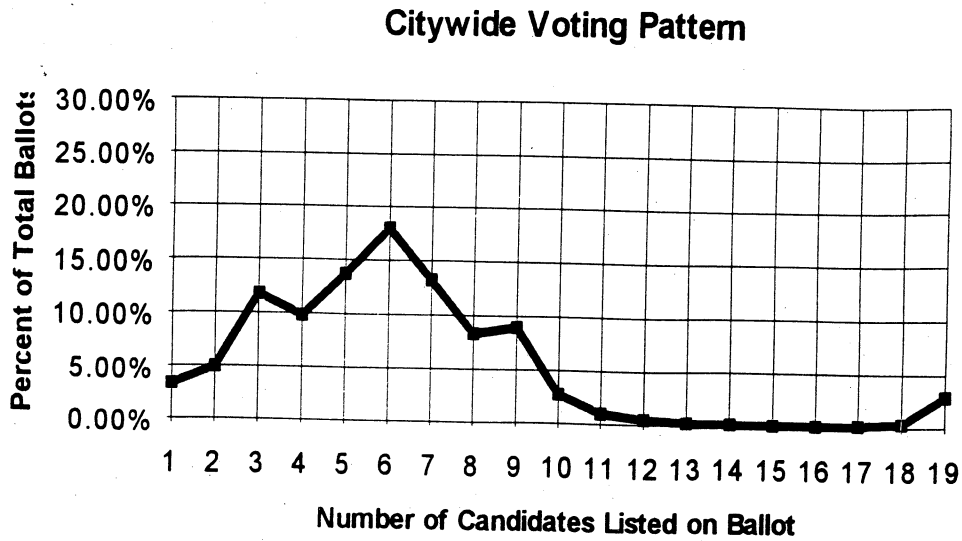
### *Educational Attainment as a Measure of Status:*

Figure 6.2 shows the strong effect educational attainment has on the amount and type of political behavior taken by a voter in an ordinal election. Educational attainment strongly influences a voter's awareness of political issues. In addition, educational attainment has the strongest effect on voter utility since it affects participation level, tolerance, efficacy and political expediency. Based on the evidence presented in Chapter 6, changes in educational attainment will probably correspond strongly with changes in voting patterns.

Educational attainment is especially crucial to defining the status of an individual. Numerous studies of social stratification processes place educational attainment as a central factor in the causal diagram. Sociological studies show educational attainment to have a direct effect on an individual's first occupation, current occupation and income. Most importantly, educational attainment mediates the effects of other factors that define status. For example, the effects of parent's education and occupation have little direct effect on a person's current occupation and income except through their influence on his or her education (Curtis & Jackson, 1977).

Since educational attainment is shown to have a significant effect on status and political behavior, changes in voting patterns will be compared to changes in educational attainment. In order to substantiate the hypothesis that status has a predictable effect on voting patterns, the changes in both factors should produce a predictably monotonic relationship.

Figure 7.1



**The Data:**

The chart of City Wide Voting Pattern shows the voting pattern for the entire City of Cambridge in the 1991 City Council election. The horizontal axis begins at one and ends at 19 since there were 19 candidates on the 1991 City Council ballot. The vertical axis shows the percentage of voters who listed a particular number of candidates on their ballot.

This distribution shows that less than 5% of all the voter's "bullet" their ballots by listing only one candidate. Conversely, about the same number listed all 19 candidates on their ballot. The highest peak is at six followed by clear peaks at three and nine. An insignificant number of voters choose to list candidates between 11 and 18.

The distribution is fairly symmetrical up to 10 candidates. This may be due to the fact that Cambridge allocates nine seats in this election. The small peak at 19 indicates that some people did seek the "negative utility" explained in Chapter 5 by listing arbitrary choices between their most favored and least favored choices. This does not account for all of the persons listing all available candidates, however. Some people will list all the candidates simply because the ballots explain that it is possible to do so. In any case, the fact that the percentages drop off dramatically after 10 listings indicates that the number of seats has a dramatic effect on the number of listings a voter will make. This supports the hypothesis that voters consider the number of seats to be allocated as opposed to simply designating a single champion.

By looking at the city wide average, we can determine that there are significant indicators at the points of three, six and nine. The number of voters who bullet their ballots is also significant, but has mixed meaning. Certainly, a bullet vote may indicate that marginal voter utility reached zero extremely fast. However, it may also indicate that the voter does not understand the concept of ordinal voting. The bullet vote is an interesting, but inconclusive indicator of voter utility.

The number of people who list nine candidates is likely to be strongly affected by the fact that there are nine seats to be allocated. This may prompt some people to vote for nine regardless of their actual level voter utility. Therefore, this number may not be a reliable indicator of actual voter utility. If the percentage of people who choose to list nine candidates remains fairly constant as educational attainment changes, we can assume that the number of seats to be allocated had a significant effect on voters. If the number of people choosing nine candidates changes significantly as educational attainment changes, we can assume that there are other factors affecting this peak.

Thus, we can assume that the peaks at three and six are the most likely to react with changes in educational attainment. In order to test the effects of educational attainment on voting patterns, I have split the city into six different groups. Each group contains a number of precincts that show voting patterns of similar efficiency levels. Precincts 8-2, 8-3, 2-2, 2-3, 2-4 were excluded from this analysis because their populations are primarily students associated with Harvard and MIT.

The groupings listed in table 7.1 are in descending order of efficiency. As stated in Chapter 6, efficiency is a measure of a constituency's ability to express voter utility and to apply that utility uniformly. Distributions with a single peak are considered more efficient than a distribution with several peaks. Although not entirely conclusive, a single peak indicates that voters in that area were capable of producing a higher degree of uniform expression.

The total amount of voter utility expressed by individual voters creates the incentive to include more listings on a ballot. Thus, we can also expect the most efficient distributions to demonstrate a tendency toward listing more candidates than the less efficient distributions.

Table 7.1 Precinct Groupings

<i>Efficiency</i>	<i>Description</i>	<i>Precincts Included</i>
1. Highest	North/West Harvard Sq	7-1, 7-2, 7-3, 7-4, 8-1, 8-4, 9-1.
2.	Mid-Cambridge Area	3-3, 3-4, 4-1, 4-2, 6-2, 6-3, 6-4
3.	North/West Strip	10-1, 10-2, 10-3, 9-2, 9-3
4.	Cambridgeport/Riverside	4-3, 4-4, 5-1, 5-2, 5-3, 5-4, 6-1
5.	North/West Border	9-4, 10-4, 11-1, 11-2, 11-3, 11-4
6. Lowest	East Cambridge/Area 4	1-1, 1-2, 1-3, 1-4, 2-1, 3-1, 3-2

The following pages include a map highlighting the geographic boundaries of each grouping in black. The areas excluded from the study are highlighted in gray. The outline of Fresh Pond is included as a reference point. Under each map is a chart showing the voting pattern for the area outlined in black. Like table 7.1, these pages are in order of descending efficiency of the voting pattern. Under the voting pattern distribution is a table showing the educational attainment for the given area. This information is from the 1990 US Census data for residents 25 years of age or older.

\* Precincts reflect 1991 lines

Figure 7.2 North/West Harvard Square  
Precincts 7-1, 7-2, 7-3, 7-4, 8-1, 8-4, 9-1

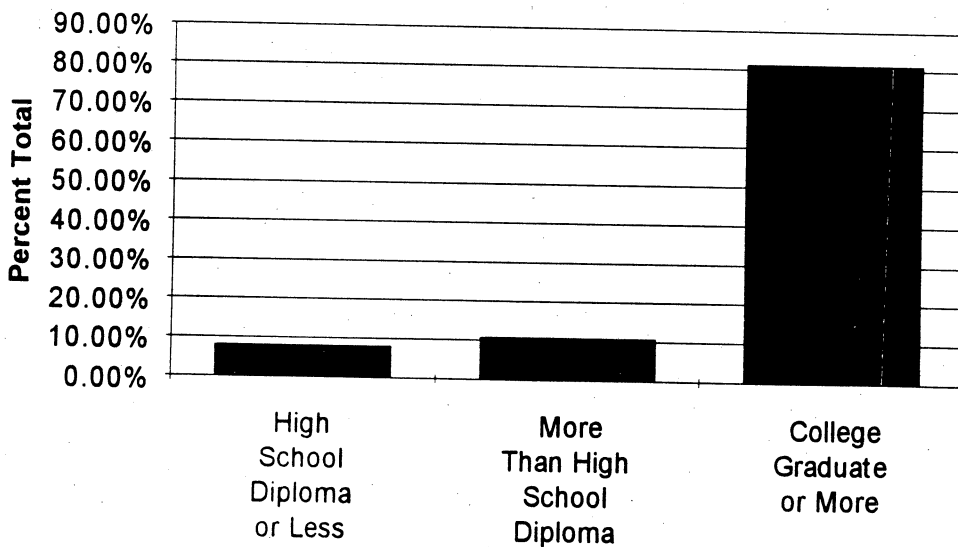
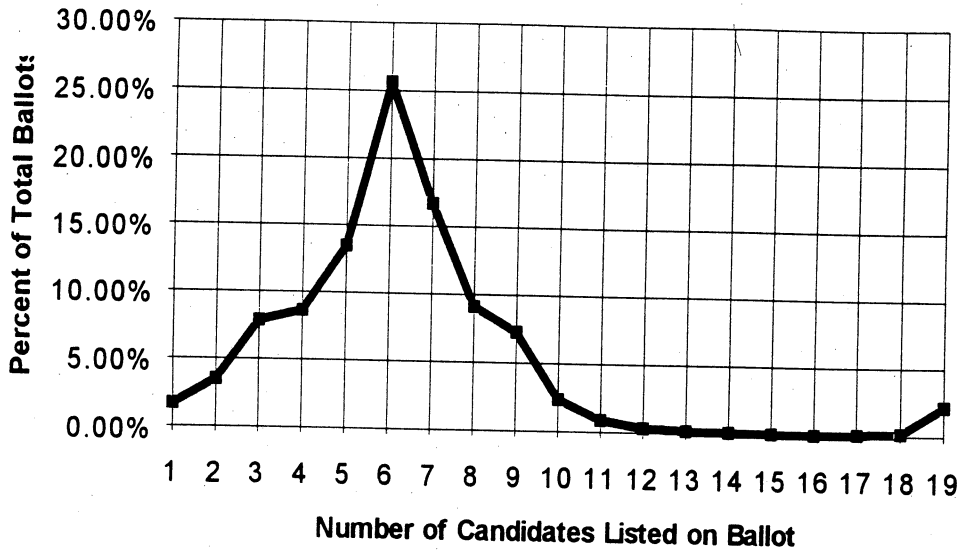
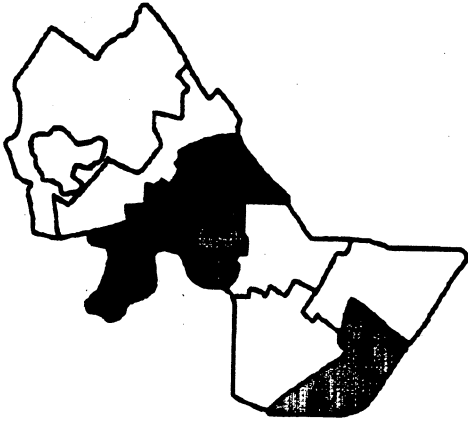


Figure 7.3 Mid-Cambridge Area  
Precincts 3-3, 3-4, 4-1, 4-2, 6-2, 6-3, 6-4

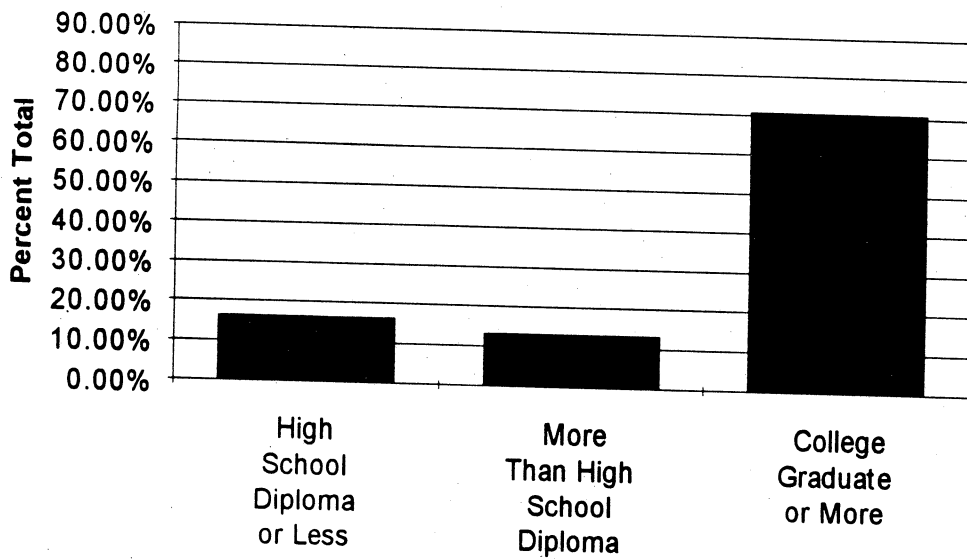
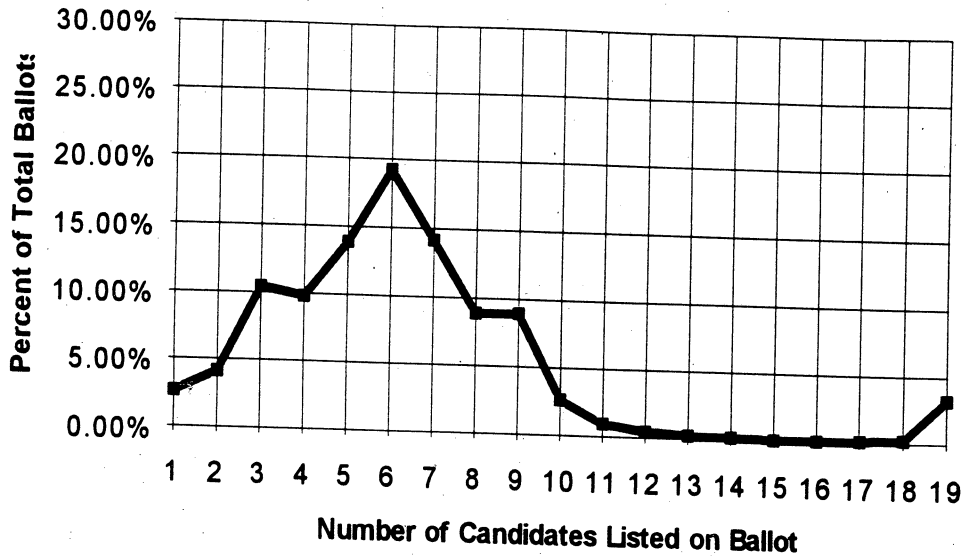
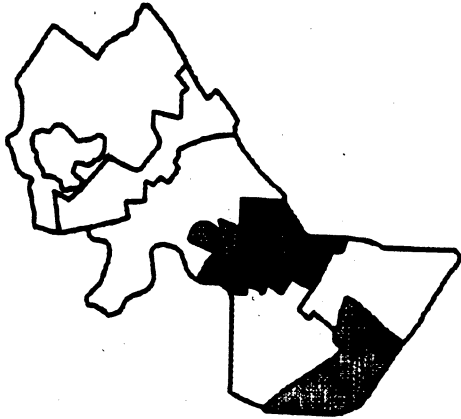


Figure 7.4 North/West Strip  
Precincts 10-1, 10-2, 10-3, 9-2, 9-3

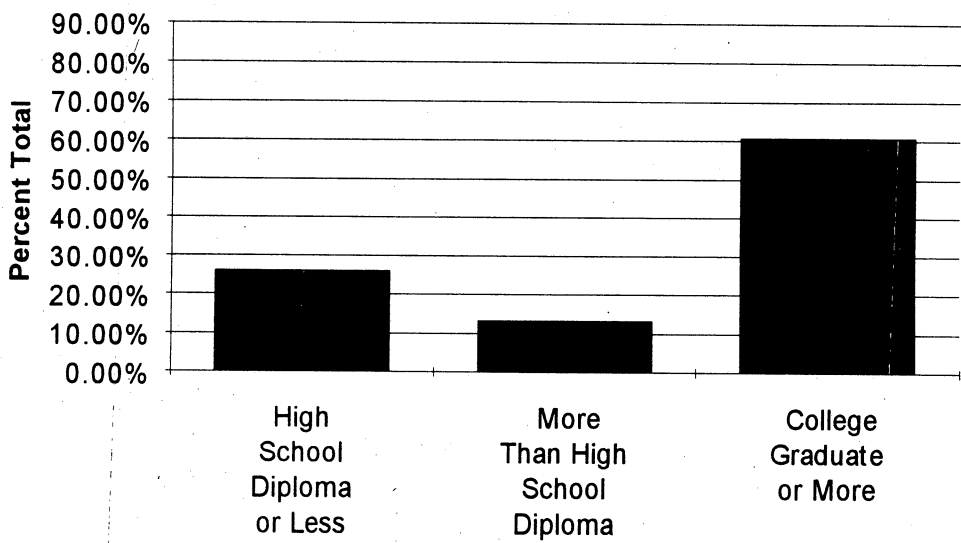
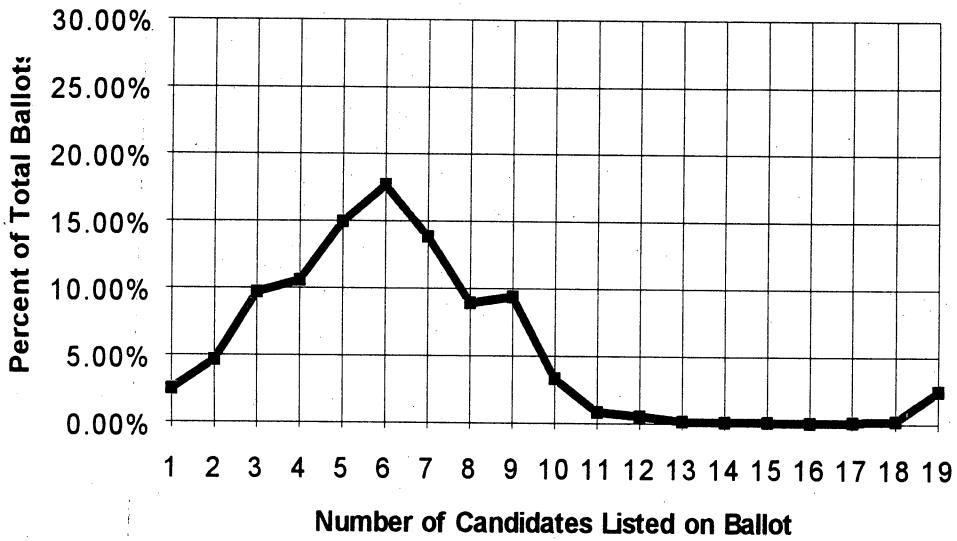
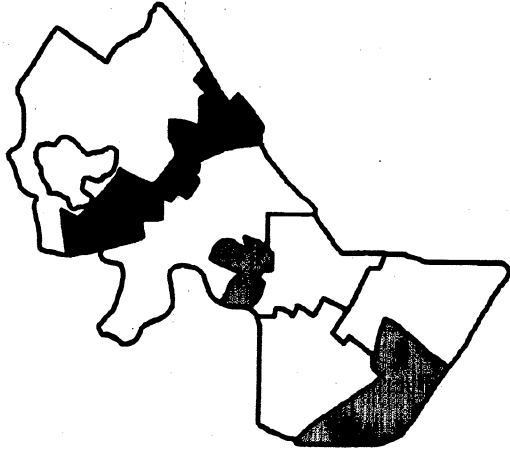


Figure 7.6 Cambridgeport/Riverside  
Precincts 4-3, 4-4, 5-1, 5-2, 5-3, 5-4, 6-1

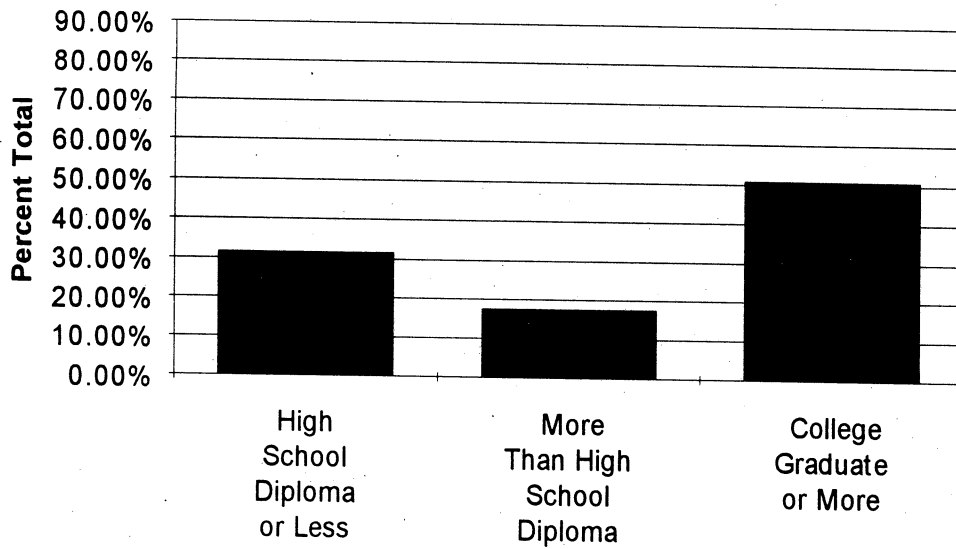
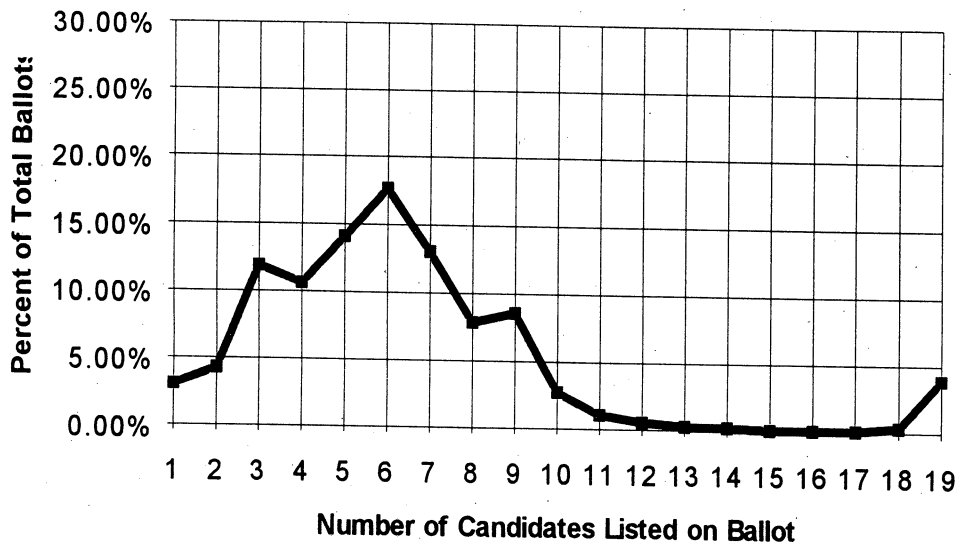
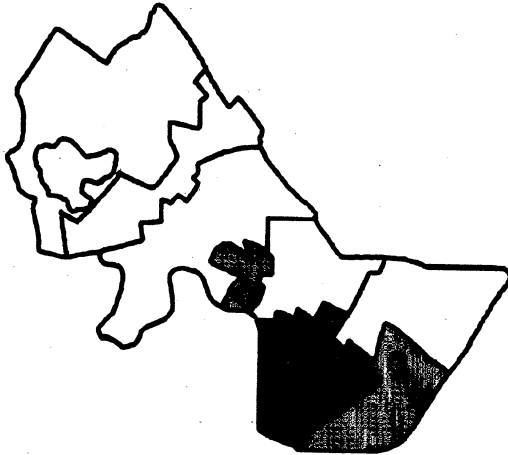


Figure 7.6 North/West Border  
Precincts 9-4, 10-4, 11-1, 11-2, 11-3, 11-4

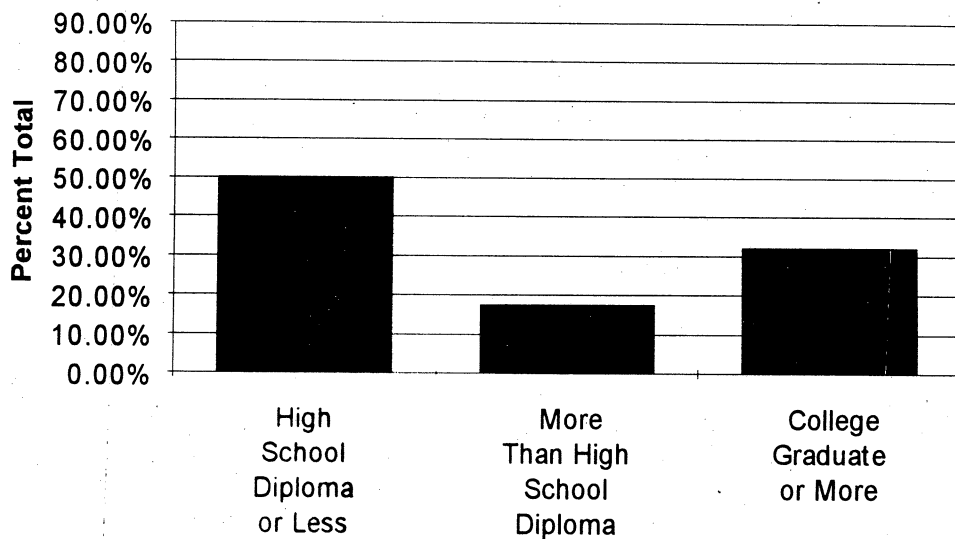
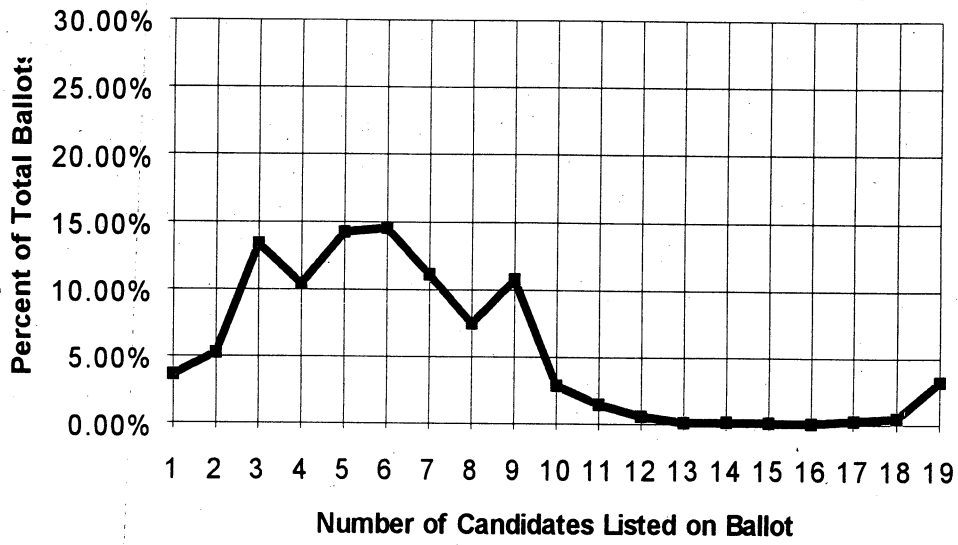
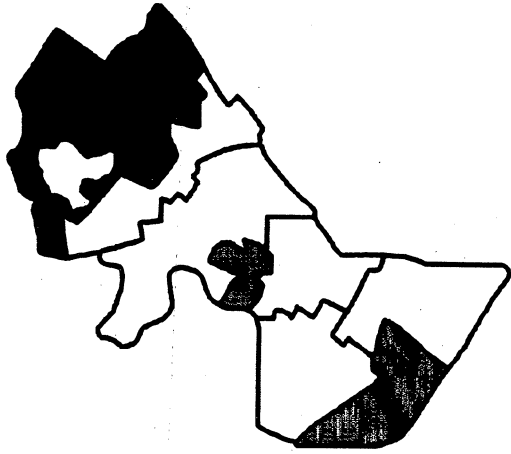
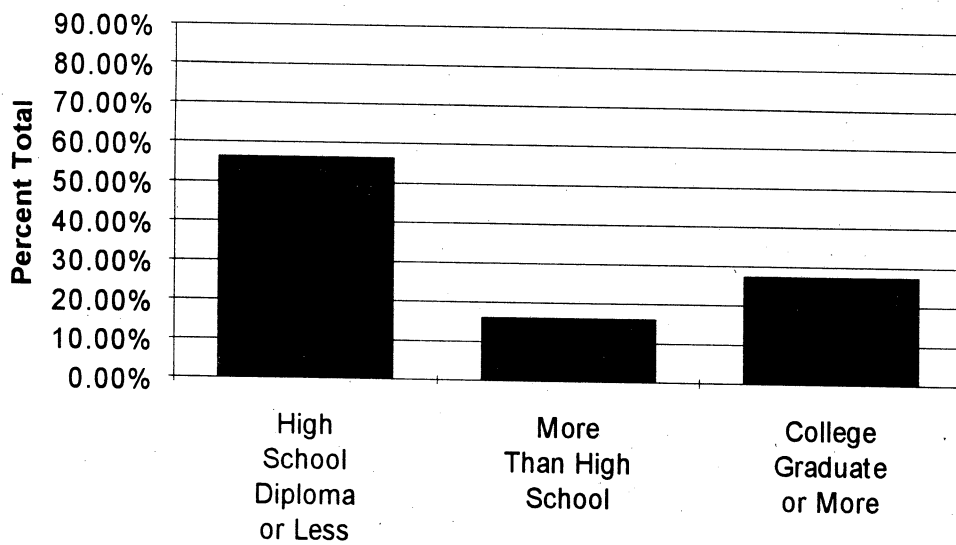
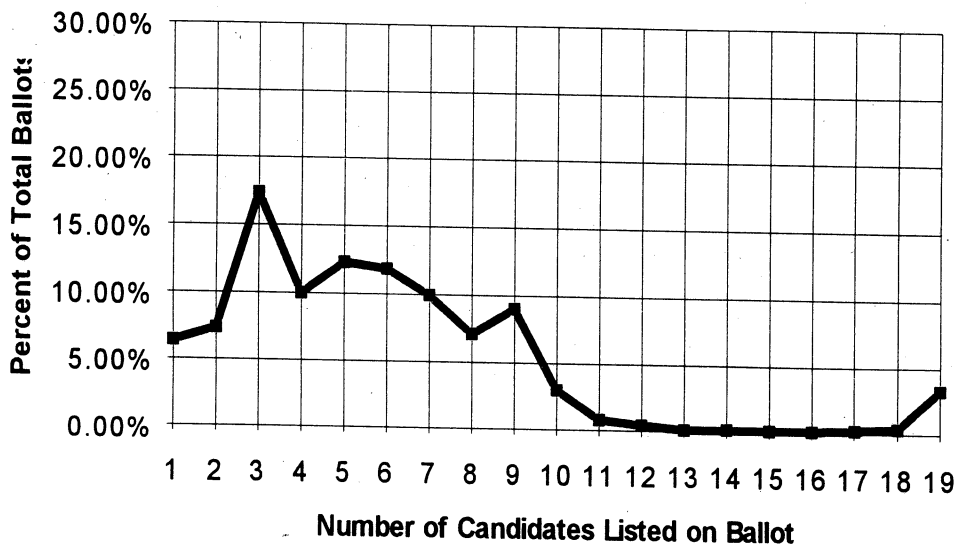
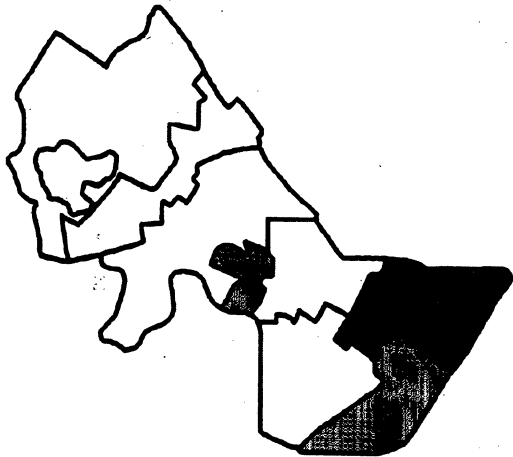


Figure 7.7 East Cambridge/Area 4  
Precincts 1-1, 1-2, 1-3, 1-4, 2-1, 3-1, 3-2



### *North/West Harvard Square:*

The North/West Harvard Square group includes the neighborhoods abutting Harvard Square to the west, beginning in the Agassiz neighborhood on the Somerville line and proceeding southwest. This study group includes Avon Hill and other parts of Neighborhood Nine, Brattle Street and the Coolidge Hill neighborhood.

Educational attainment is extremely high in this area of the city. Over 80% of the adult population completed at least college level study. In addition, more than half of the college graduates in this area have completed advanced degrees.

More than any other, this area reflects the historical influence of Harvard University. Stately mansions still house families descended from wealthy merchants of the 18th century. Certain places still convey such a strong sense of rooted aristocracy that tour buses endlessly parade this neighborhood in the spring and summer months. Interestingly, one of the sights includes the former home of Massachusetts Governor Eldridge Gerry, namesake of the gerrymander technique explained in Chapter 3.

Although the section to the north of Massachusetts Ave. does not share as long a history as some the other sections, it is no less prestigious due to its direct proximity to Harvard University. Many of the well established faculty members and administrators at Harvard make their homes in this area. The convenient location combined with wide, picturesque streets and homes has kept this area a consistently strong attraction to the elite members of the Harvard community.

### *Efficiency:*

The correlation between high educational attainment and efficient balloting is clearly apparent in the investigation of this area's voting pattern. The highly symmetrical, unimodal distribution around the norm of six is a strong indication of uniform and, consequently, efficient voting. Based on the evidence presented in Chapter 6, we can assume that high levels of voter utility made it possible for voters in this area to list a greater number of candidates before their marginal utility reached zero. In addition, we can also assume that the greater ability to uniformly express voter utility and the effects of classism reduced the tendency to vote for more than the accepted number of candidates.

Note that this area has the smallest percentage of bullet votes of the six areas analyzed. Similarly, the peaks at three and nine, although apparent, are relatively suppressed. This area shows a high level of voter utility and uniformity in its expression. It is the most efficient area of the six outlined in this study. It also has the highest educational attainment of the six areas outlined in this study.

### *Mid-Cambridge Area:*

The neighborhood of Mid-Cambridge shows the second highest level of educational attainment in the city. This area is bounded by Harvard Square to the west and Somerville to the north. It extends east to Prospect Street, but remains to the north of Central Square. It includes City Hall and slopes past the western border of the Riverside neighborhood to include the neighborhood to the southeast of Harvard Square.

A neighborhood mixed with multi-family homes and large apartment buildings, this area is one of the most densely populated places in the city. Although mostly private housing, Harvard University, the largest landlord in Cambridge, owns a considerable amount of rental property in this area. A well established and stable community in many ways, this area does, however, have a relatively high turnover of residents, many of which are older students associated with Harvard University and MIT. If the North/West Harvard Square area reflects the historical presence of Harvard, this area reflects the university's more contemporary presence.

### *Efficiency:*

The distribution of votes, although still symmetrically peaked at the norm of six, is clearly trimodal. This indicates a less uniform expression of voter utility. Compared to the first area, a higher percentage of voters deviated from the uniform expression of utility by listing more or less candidates than the norm of six. This accounts for the more prominent peaks at three and nine. The relatively high turnover rate may preclude the ability to develop effective communication networks and may have contributed to this decline in uniformity. This may explain why the decline in uniformity is severe while the drop in educational attainment is slight.

The expression of voter utility remains relatively high, although the decline of people listing the norm of six and the slight increase in the number of short ballots indicates that there has been a drop in efficiency. This decline corresponds with the decline in educational attainment.

### *North/West Strip*

The North/West Strip is a mixing ground where the working class expansion of North Cambridge weaves with the upper class boundary of Old Cambridge. The area includes Porter Square, Walden Street and Upland Road, the Grey Gardens neighborhood and a significant parts of West Cambridge. This relatively thin strip has approximated the line of demarcation between the long established upper classes and the aggressive expansion of the working classes. In recent years, the expansion of the MBTA Red Line combined with the real estate boom of the last decade suppressed the traditional divisions, making this line a softer weave. However, the area maintains its role as a divider. It is home to a unique mixture of upper class academics, affluent professionals and working class families.

The working class heritage of this area shows in the relatively high increase in the number of adults that who have no more than a high school education. The strong number of college graduates indicates a dominant presence of upper and professional class residents.

***Efficiency:***

The distribution of ballots in this area indicates a continuing rate of decline in efficiency that corresponds with the decrease in educational attainment. The distribution remains trimodal, but is less sharply defined. This indicates that the uniform expression of voter utility has continued to decline since a larger proportion of voters choose to list a number of candidates different than the norm. Correspondingly, the norm of six has fallen several percentage points.

A change in the level of voter utility is not clearly apparent when comparing this distribution to the last. Although the softening of the trimodal shape indicates less efficiency due to less uniformity of expression, there is no discernible change in the level of voter utility.

Although the change in efficiency seems to be created solely by a decrease in uniform expression of voter utility, the decline in efficiency continues to correspond with the decline in educational attainment.

***Cambridgeport/Riverside***

The Cambridgeport/Riverside area continues the erosion in the uniformity of voting patterns. This area is also a mix of working class and professional residents. As compared to the last distribution, note that the lowest level of educational attainment rose 10% while the highest level of educational attainment decreased by approximately the same amount. The Cambridgeport/Riverside area historically and currently has a strong working class influence, particularly in the area surrounding Central Square.

Bordered on the southeast by railroad tracks and on the southwest by the Charles River, the Cambridgeport/Riverside area is one of the most distinct groupings in this study. Its northern border is defined in contours that rise to neatly intersect with the Mid-Cambridge area described earlier.

***Efficiency:***

This area continues the pattern of decline in efficiency, but in the opposite manner of the previous distribution. The norm of six remains stable. However, the tendency to vote shorter ballots is rising. There is an increase in the peak at 3. In addition, this is the first distribution to show a tendency to be slightly skewed to the left. This indicates that lower voter utility is manifesting itself in a growing tendency to cast shorter ballots. The change corresponds with a decline in educational attainment.

***North/West Border:***

The fifth area spans the northern and western borders of the city. It is defined by the borders of four neighboring communities. To the north is Somerville, which in this area is separated from Cambridge by no distinct structure other than the strategic placement of street signs. The town of Arlington, which borders to the northwest, is separated in a more definitive

manner by Alewife Brook Parkway. Belmont is also separated clearly by roadways. Blanchard Road marks the western edge of the Cambridge Highlands neighborhood while the Belmont cemetery and the Fresh Pond golf course provide a buffer between the residents of both towns. Watertown borders the southwest corner near the Strawberry Hill neighborhood.

This area was developed at a time when many working class families were becoming firmly established in Cambridge. This section of Cambridge became a focal point for working class families wishing to purchase a home. The working/middle class nature of this area was quite stable until the real estate boom of the last decade. A dramatic increase in property values in this area was exacerbated by the extension of the Red Line to Alewife Station. Convenient access to downtown Boston combined with an attractive residential atmosphere precipitated an influx of affluent professionals which has significantly reduced the working/middle class dominance of this area.

### *Efficiency:*

This area marks a turning point in the comparison of educational attainment. This area is the first in this study where people with a high school education or less constitute the largest portion of the population.

The continuing correlation between educational attainment and voting efficiency is clear. The distribution is sharply trimodal with very prominent peaks at three and nine. In addition, the norm of six has fallen another several percentage points. This indicates a continued reduction in uniform expression of voter utility and an increasing tendency to cast shorter ballots. This reduction in efficiency corresponds with the reduction in educational attainment.

### *East Cambridge/Area 4*

The final area of the city examined in this study includes the neighborhoods of East Cambridge and Area 4. This area is the most racially and ethnically diverse section in this study. It maintains its historic role as the entry point for immigration. Beginning in the 19th century, immigrants were attracted to East Cambridge by job opportunities presented by its growing industrial base. In more recent times, immigrants remain attracted to East Cambridge and Area 4 by the variety of well established ethnic communities and the relatively affordable housing. East Cambridge is predominantly populated by residents of European ancestry while Area 4 contains a thriving Black and Hispanic community.

Although the residents of this study group share similar sociological characteristics, East Cambridge proudly considers itself a distinctly autonomous neighborhood. The most provincial residents of East Cambridge consider the railroad crossing on Cambridge Street the border of their neighborhood. Less provincial residents consider the crossing of Cambridge and Prospect Street as the outer edge of their neighborhood. Residents wearing T-shirts emblazoned with the motto "East Cambridge Begins at the Tracks" attest to this persistent, yet cordial, disagreement.

This entire area is densely populated with single and multi-family homes, apartment buildings and public housing projects liberally mixed over the entire area. Relative to the rest of Cambridge, East Cambridge remains the consummate working class community. Neighborhood groceries and proprietors still maintain a bustling clientele of local shoppers. Small storefront businesses offer a variety of goods and services targeted to the different ethnic groups that coexist in this area.

The educational attainment chart strongly reflects the working class character of the East Cambridge/Area 4 community. About 55% of all the adults have no more than a high school education. Of this number, more than half have not completed high school. Conversely, this area has the smallest number of college graduates of the six groups identified in this study. Moreover, it is likely that college graduates are over-represented in East Cambridge since they are largely defined by the relatively new luxury waterfront condominium developments. Many neighborhood activists feel that these residents do not participate in local elections to any significant degree.

### *Efficiency:*

The voting pattern firmly established by the other five sections reaches a dramatic conclusion in the East Cambridge/Area 4 section. The distribution remains trimodal, indicating that uniform expression remains low. In addition, the distribution is severely skewed to the left, indicating a continued decrease in voter utility and a strong propensity for listing short ballots. The norm of six is at its lowest level in the entire city and is not even recognizable as a peak. This indicates a severely low level of uniform expression as compared to the other areas. In addition, the number of bullet ballots is higher than in any other area. This area, by far, has the lowest level of efficiency in this study. Correspondingly, it also has the lowest level of educational attainment.

### *Conclusion:*

Clearly, this data proves beyond doubt that people in Cambridge express dramatically different perceptions of appropriate representation. In addition, this data proves beyond doubt that the differences expressed are not random, but are caused by some factor or combination of factors. Based on the strong correlation with educational attainment, it seems quite likely that sociological differences contribute to creating perceptions of representation.

Educational attainment is shown to be a significant determinant of both status and political participation. Using educational attainment as a barometer, the data presented in this chapter establishes a clear correlation between the status of a constituency and its ability to maximize its efficiency in an ordinal election. This correlation does not confirm that educational attainment causes efficiency in ordinal elections. However, the strong correlation between educational attainment and status does support the hypotheses of voter behavior in ordinal elections presented in Chapter 6.

What are the implications of proving that voting patterns in ordinal elections are not randomly produced? The most important implication is that the rules of an ordinal election must minimize favor to one type of voting pattern over another. In this chapter and the preceding

chapter, I have highlighted relative differences in ordinal voting patterns by comparing their level of efficiency. Efficiency, as used in this study, is the ability of the voters in a given constituency to produce and uniformly express voter utility. The data from this chapter show conclusively that some voting patterns are more efficient than others.

In order to ensure a fair ordinal election, the voting system must not disproportionately reward efficiency. To do so would be to bias the election in favor of constituencies that are more capable of producing efficient voting patterns. As this data suggests, to disproportionately favor efficiency would mean to bias the election in favor of higher status constituencies.

At the end of Chapter 5 I stated that the ability to interpret variable levels of voter utility makes it impossible to assume that a change in quota will not change how an ordinal election system interprets the value of one voter's utility relative to another voter's utility. Chapters 6 and 7 provide the outline of how the expression of voter utility can change. With this information it is possible to identify the characteristics of quota that would change how an ordinal system interpret the value of one voter's utility relative to another voter's utility.

The data of chapters 6 and 7 show conclusively that some voters will predictably list more candidates than other voters. In addition, the data show a strong correlation that proves these differences do not occur randomly. Based on these facts, I can conclude that a quota which forces the system to allocate ballots based on deeper preferences is inherently biased.

Similarly, the data of chapters 6 and 7 show conclusively that some constituencies are more uniform in their expression of utility. In other words, some constituencies are more successful at communicating with their members to vote uniformly for a designated norm of listings. Although changes in uniform expression could be caused by factors of chance, the predictable deterioration of uniformity demonstrated in this chapter support the hypothesis that uniformity in ordinal elections is precipitated by certain social conditions. Since uniformity of preferencing provides an advantage when votes are transferred, I can conclude that a quota which increases the transfer of ballots is inherently biased.

In practice, these two factors of bias work simultaneously. Increasing the number of transfer ballots automatically requires allocating on deeper preferences. Yet it is important to understand that the effect of bias is twofold. First, allocating on deeper preferences forces short ballots to exhaust at a faster rate. This is the effect of quickly diminished voter utility. Second, even when ballots are long enough to stay active, more uniform constituencies stay focused on a preset goal as allocations are made on deeper preferences. Conversely, less uniform constituencies tend to diffuse their support as allocations are made on deeper preferences, even though some of their ballots may contain as many listings as more uniform constituencies.

#### *Afterword on the Effect of Election Conditions:*

Election conditions, such as the number of candidates running and the endorsements of political organizations, etc. have thus far not been specifically mentioned in this work. While particular election conditions are not germane to the discussion of the material presented in the

first 6 chapters, one can easily assume they play a significant role in the data presented in this chapter.

When discussing the role of election conditions it is important to understand that election conditions do not change the principle conclusion of Chapter 7: that ordinal voting patterns are not produced randomly. The issue of election conditions only affects the hypotheses presented in Chapter 6 which is consequently supported by Chapter 7: that higher status tends to result in more efficient ordinal voting patterns.

The distinction is an important one. I have proven that ordinal voting patterns are caused, but I have not proven conclusively what causes them. The correlation between educational attainment and ordinal voting patterns is definitive proof of cause, but it would be inaccurate to say that it is itself the cause.

Without conclusively saying that educational attainment is a cause of ordinal voting patterns one may argue that election conditions are more significant than educational attainment in the cause of ordinal voting patterns. Cambridge election watchers know that the most prominent political organization in the city endorsed six candidates for election in 1991. One could argue that in the event this organization chose to only endorse three candidates, the hypothesis of efficiency based on status would be largely invalidated.

To propose this argument is to assume that educational attainment and the actions (or existence) of political organizations are independent of each other. This would be an incorrect assumption. If it were possible to model the complete process responsible for the cause of ordinal voting patterns, it is highly likely that we would find political organizations and educational attainment to hold significant roles. More importantly, it is likely that we would find a significant relationship between educational attainment and the operations of political organizations.

It is incorrect to declare that election conditions are not considered in the findings of Chapter 7. Educational attainment is a causative agent in so many aspects of socio-political interaction it would be impossible not to include election conditions as a factor in the correlation with ordinal voting patterns.

I do not propose that educational attainment correlates with ordinal voting in spite of election factors such as political endorsements. Rather, I propose that educational attainment correlates with ordinal voting through election factors like political endorsements. While the shapes of the graphs presented in this chapter will certainly change from election to election based on changes in election factors, the correlation will remain largely the same. Ordinal voting patterns will always be caused. Educational attainment, through an unknown number of other factors, will always have something to do with it.

## Chapter 8: Answering the Quota Question

Chapter 8 returns to the mechanics of STV and applies the evidence presented in chapters 6 and 7 to demonstrate the specific ways in which quota definition in an ordinal election can create a status based bias. With an understanding of how the efficiency of ordinal voting patterns changes with status, this chapter will examine how different quota definitions react to differences in efficiency. It will show which quota mitigates the differences of status and which quota exacerbates the differences of status. In short, this chapter provides the answer to the quota question.

As discussed in Chapter 3, the two most common quotas are known as the Droop quota and the Hare quota. Respectively, the Droop and Hare quotas represent the minimum amount of votes and the maximum amount of votes needed to elect one member of an elected body of any given size. The Droop quota is the historic standard and remains the quota formula used in Cambridge. Since there are nine seats elected on the Cambridge City Council, the Droop quota is the smallest total of votes that will allow (at most) nine candidates to reach quota.

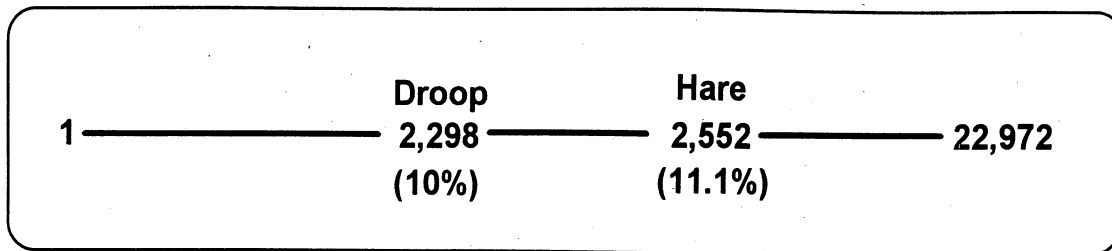
### *The "Natural" Quota:*

Virtually all of the discussion regarding bias in STV will concern Droop vs. Hare. However, we have not yet defined exactly why these formulas define the only reasonable quotas to be used in STV elections. Without regard to the number of seats to be allocated, one could set an election quota to any number between 1 vote and the total vote cast. In 1991 Cambridge City Council election this would mean the quota could be set anywhere between one and 22,972. A quota of one would mean Cambridge would have the equivalent of a town meeting government. Each person that wished to have an issue considered could conceivably elect himself. A quota of 22,972, even with a transfer process, would make the election a plurality race.

Since we are seeking to allocate nine seats proportionally, it would be impossible to set the election quota anywhere near the extremes of 1 or 22,972. But what makes Droop (2,298) and Hare (2,553) better than any other numbers? Why couldn't the quota be rounded to 2,000 votes or perhaps 3,000 votes? The answer is twofold. First, the quota must elect only the given number of seats in the election. Second, the quota must create the most proportional results possible. The quota that best satisfies these two criteria can be considered the "natural" quota.

As mentioned in Chapter 3, Droop and Hare create a specific range within a given total of votes. Figure 8.1 is a number line showing the range between Droop and Hare during the 1991 Cambridge City Council election.

Figure 8.1 A Quota Number Line



Given the same number of seats to be allocated and the same vote total, the Droop quota will always be smaller than the Hare quota. As explained in Chapter 3, this is because the Droop quota formula increases the denominator of the Hare quota formula by one. In Cambridge 1991, this results in a 1.1% (254 vote) difference between Droop and Hare.

***Electing the Right Number:***

The first criteria for the natural quota is that it must allocate the proper number of seats for a given election. In Cambridge there are nine seats to be allocated. Referring to the number line, what would happen if the quota were to be set at a number between 1 and 2,298? In other words, what could happen if we made the quota smaller than the Droop quota? Refer to the example of 2,000. There are nine seats to be allocated in the election. Each candidate that reaches the quota of 2,000 votes will be declared elected to the Cambridge City Council. Since there were 22,972 votes cast in the election, the problem is apparent after some simple division.

Figure 8.2 Quota of 2,000

$$22,972 / 2,000 = 11.48 \text{ Seats}$$

A quota of 2,000 would make it possible for more than nine candidates to reach quota. Thus, any quota smaller than the Droop quota could allow too many candidates to reach quota. Compare figure 8.2 with to the Droop quota in figure 8.3:

Figure 8.3 Droop Quota Seats

$$22,972 / 2,298 = 9.99 \text{ Seats}$$

The Droop quota only allows 9 seats to be allocated. While there is a remainder of .99, this is still several votes shy of electing the 10th seat. By adding the extra vote to the quotient of the Droop quota, it becomes impossible for a 10th candidate to reach quota.

***Droop's Extra Vote:***

In order to see the importance of the Droop Quota's extra vote, let's calculate the Droop quota without it. Thus, the Cambridge 1991, election quota would be as shown in figure 8.4.

Figure 8.4 Droop Formula Without Extra Vote

$$22,972 / (9+1) = 2297 \text{ (rounded down)}$$

Obviously, this number could allocate too many seats in the election:

Figure 8.5 Seat Proportion of Droop Formula Without Extra Vote

$$22,972 / 2297 = 10 \text{ Seats}$$

The math is simple, but the importance of this extra number strikes close to the heart of the bias created by the Droop quota. Thus, it is important to outline the function of adding an additional vote to the division result in the Droop quota formula.

The following graphs illustrate the effect of the extra number used in the Droop Quota. Each graph shows the total votes of the last ten candidates, assuming all votes in the election have been transferred.

Figure 8.6

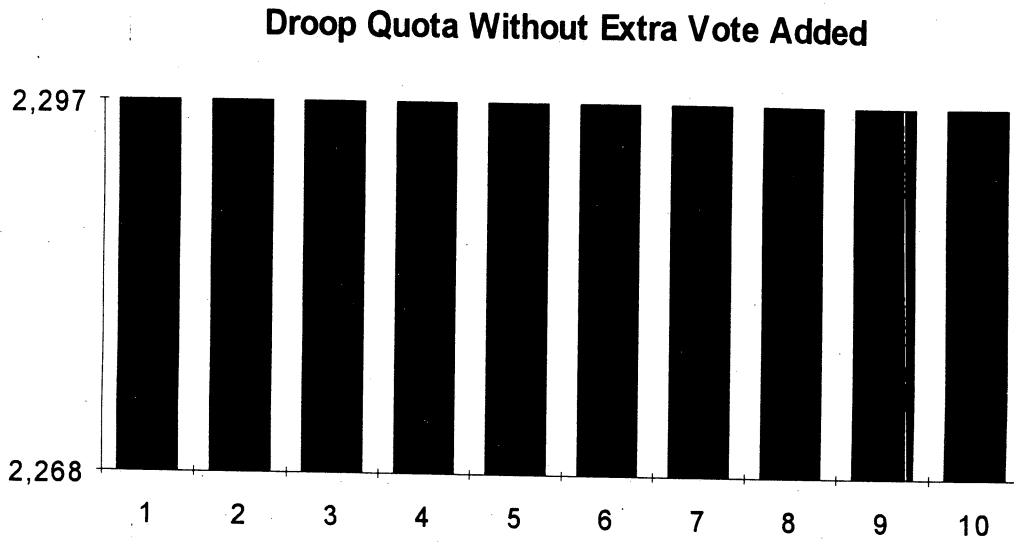
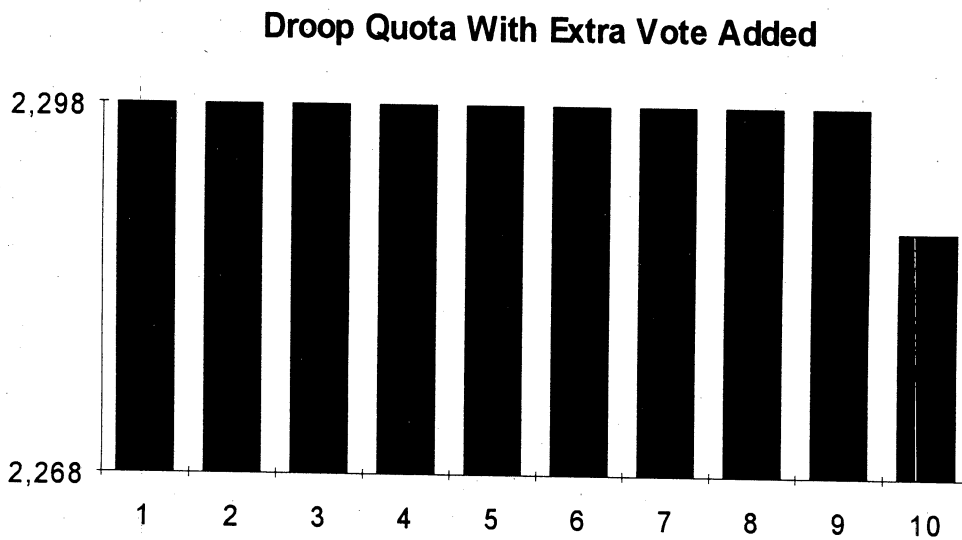


Figure 8.7



Notice that when the extra vote is removed from the Droop quota formula, it becomes possible for the tenth candidate to reach quota. However, when the extra vote is added to the quota formula, the tenth candidate will always be at least 9 votes short of quota. Thus, the results of the Droop quota in a nine seat election are summarized as shown in figure 8.8.

Figure 8.8 Summary of Droop Allocation

$$(10\% + 1)9 \text{ candidates} = 90\% + 9$$

The Droop quota caused the system to allocate seats by counting only 90% + 9 of the votes (at most) in the election of the representative body. Since 9 elected candidates will equal 90%+9 votes, there will always be a remainder of 10% - 9 votes that are not allocated

to one of the elected representatives at the end of the election. Once nine seats are allocated, the remaining votes will always total nine votes short of a full quota allocation. Thus, the Droop quota is the smallest number that will elect no more than the proper number of seats.

However, one can say that the Droop quota also leaves the largest remainder of votes excluded from the election of one of the nine allocated seats. Since Droop is the smallest quota that elects a given number of seats, it must also be the quota that leaves the largest remainder of unallocated (exhausted) votes. This is true in any election using the Droop quota, regardless of how people vote. It is commonly thought that exhausted ballots only come from short ballot voters. Although this belief is based in truth, it is not entirely correct. Even if every voter provided a listing for every candidate in a Droop quota election, there will still be a remainder equal to quota minus nine votes. If nine seats are allocated using only  $90\% + 9$  votes, there will be a remainder of  $10\% - 9$  votes, regardless of how many preferences voters list on their ballots.

The remainder created by using Droop is the heart of bias in STV elections. Incorporating a remainder of ballots which are not counted toward the election of one of the representatives raises the question of whether ballots of certain voters are more likely to end up as remainders. Chapters 6 and 7 prove conclusively that ordinal voting patterns are not created randomly. Because of this fact, we cannot assume that the Droop quota's remainder of unallocated ballots is created randomly (i.e. without respect to status).

The evidence in chapters 6 and 7 indicate that the more a quota forces ballots to be allocated on deeper preferences, the more likely it is that the ballots of lower status voters will become exhausted. Since the Droop quota always produces a remainder that is not allocated to any elected representative, exhausted ballots will always be part of the unallocated remainder in a Droop quota election. Therefore, if the Droop quota forces ballots to be allocated on deeper preferences, it is reasonable to assume that this will increase the probability of lower status ballots remaining unallocated at the end of the election.

### *The Hare Quota:*

The next section of the number line in figure 8.1 is the interval between the Droop quota and the Hare quota. This is the interval where only the proper number of candidates can reach quota. However, if nine candidates can reach quota on any number between Droop and Hare, how are they different?

The answer lies in the remainder. Since Droop is the smallest quota that will elect the proper number of seats, it is also the quota that will leave the largest remainder. As the quota increases, the size of the remainder decreases. This process continues until the Hare quota is reached. Thus, the Hare quota is distinguished because it is the only quota that will allocate the appropriate number of seats without leaving a remainder of unallocated votes. Indeed, the Hare quota is the "natural quota".

### ***Deviation From Proportionality:***

I have not yet discussed the remainder of the number line shown in figure 8.1. What if the quota was set at a number above the Hare quota? It would still be possible to elect the right number of seats. Imagine if the quota was set at 100% (22,972). Certainly no single candidate would ever attain 100% of all the votes cast in the election. However, it would be possible to declare the lowest candidate defeated and transfer her votes to remaining candidates. Indeed, this process could be continued until only nine candidates remained. Thus, the nine candidates with the highest final vote totals would be declared elected.

Although votes are still transferred, the process begins to resemble a plurality election. Accordingly, the election system would begin to exhibit the problems of a plurality election. Constituencies with enough votes to elect two or more representatives may only elect one, even if all their voters list all their preferred candidates. Indeed, in the absence of a proportional quota, all the votes could be lumped towards the election of one candidate, causing the defeat of other preferred candidates. Thus, strategic voting again becomes an issue.

Essentially, the higher the quota is set over the Hare quota, the more the results will deviate from proportionality. Taagepera and Shugart define deviation from proportionality as the difference between the percentage of votes received and the percentage of seats attained. Thus, perfect proportionality would be achieved when the percentage of votes received and the percentage of seats attained are equal for all candidates reaching quota (Taagepera & Shugart, 1989, p. 105).

It is no surprise to see that the Hare quota is the only point on the number line where the percentage of votes received and the percentage of seats attained are equal for all candidates reaching quota. In order to demonstrate this, consider the formulas presented in figure 8.9, which use the Cambridge 1991 results as an example.

Figure 8.9 Comparison of Allocation Proportions

<b>Seat Proportions</b>	$100\% / 9 \text{ seats} = 11.1\% \text{ of total seats}$
<b>Hare Quota</b>	$22,972 / 9 \text{ seats} = 2553 \text{ or } 11.1\% \text{ of total vote}$

The Hare quota is equal to perfect proportionality because it leaves no remainder of votes unallocated after all available seats are filled. Thus, we can also say that the Droop quota is inferior to Hare because its remainder causes it to deviate from proportionality. Bringing the comparison between Droop and Hare full circle, I can state that the percentage of votes remaining after all seats are allocated equals the total deviation from proportionality. Since the Droop quota leaves approximately 10% of the votes unallocated in a Cambridge City Council election, I can also state that the Cambridge City Council elections using the Droop quota deviate from proportionality by approximately 10%. While this is certainly better than the deviation associated with plurality elections, which can reach well over 30%, it is also clear that more accurate proportions are possible.

### *Supporting the Droop Quota:*

There are two arguments that have historically been used to support the use of the Droop quota over the Hare quota. The first is a normative argument based on assumptions the counting procedure recognizes regarding the interpretation of each voter's wishes as expressed by each voter's list of preferences. The normative argument also addresses the issue of the unallocated remainder created by using the Droop quota.

The normative argument supporting the Droop quota is questioned in two ways. First, I define a difference between the responsiveness of an election system and the fairness of an election system. I proposed that while the Droop quota may improve responsiveness, this cannot be considered synonymous with improving fairness.

Second, I will argue that since the normative argument for the Droop quota considers only quantities of votes effected, the assessments of its effects is incomplete. Since the efficiency of voting patterns is not random, the analysis of quota must also consider rates of change. I will show how quota affects rates of change by explaining the divergence factor in STV elections. Divergence exists regardless of quota definition. However, I will demonstrate why divergence is increased by the Droop quota and why increased divergence contributes to bias.

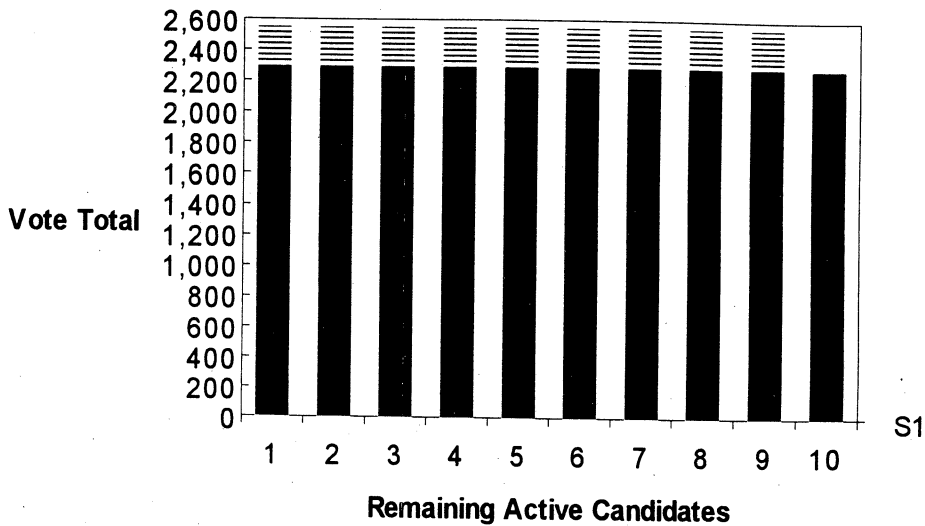
The second argument for support of the Droop quota is a mathematical theory that demonstrates how a minority of votes can gain a majority of seats when the Hare quota is used. In addition, this argument asserts that Droop eliminates this possibility. As I will demonstrate later in this chapter, the mathematical argument for Droop is invalid because it is based on unrealistic assumptions.

### *The Normative Argument for Droop:*

The normative argument for the Droop quota focuses on when a typical voter would choose to have his ballot transferred to the next candidate listed on his ballot. Obviously, a voter would like to have his ballot transferred if his first choice was declared defeated. Also, a voter would like to have her ballot transferred if her first choice has already been declared elected.

The discrepancy is defined by the difference between when a candidate is declared elected and when a candidate is assured of election. The Droop quota defines the point at which a candidate is assured of election. Regardless of what is defined as the official quota, once a candidate reaches the Droop quota, she cannot be defeated by any other candidate. Figure 8.10 illustrates this point by comparing the Droop quota and the Hare quota of the Cambridge, 1991 election.

Figure 8.10 Droop and Hare Compared



The Droop quota totals are represented in solid black while the Hare quota totals are represented in stripes. As stated earlier, the remainder left by Droop (column 10) will be ten votes less than any of the first nine columns. This is due to the extra vote added in the Droop quota formula. Since it is impossible for the remainder to be bigger than the Droop quota, it is impossible for a 10th candidate holding the remainder votes to defeat a candidate that has already achieved Droop quota.

Since any candidate who reaches the Droop quota cannot be defeated, Droop quota proponents argue that any candidate receiving votes after reaching the Droop quota is wasting votes. Referring to figure 8.10, we can see that the total votes "wasted" by allowing candidates to reach the Hare Quota is exactly equal to the number of votes "wasted" by the Droop quota. Since the Hare quota adds about 1.1% to each of the nine candidates elected, the total "wasted" is about 10%. Thus, proponents of the Droop quota state that there is no difference in how well the two quotas utilize votes (Lakeman, 1970, p. 38).

Inherent in this argument is the assumption that the voting patterns of different constituencies are random (i.e. levels of efficiency are not caused by social factors). In other words, the Droop quota's propensity for increasing the number of ballots allocated on deeper preferences is equally fair for all constituencies. Chapters 6 and 7 proven conclusively that preferences are not equally efficient for all constituencies. Moreover, this evidence strongly suggests that the ballots of higher status voters will transfer at a much higher rate of efficiency than ballots of lower status voters. The increased sensitivity to differences in efficiency is the bias created by the Droop quota. Reducing the quota increases the importance of efficiency because it increases the number of ballots transferred and forces them to be allocated on deeper preferences. The Droop quota disproportionately favors longer, more uniform expressions of voter utility. In short, since the Droop quota disproportionately favors efficiency, the Droop quota disproportionately favors higher status constituencies.

### ***Responsiveness vs. Fairness:***

Clearly, there is a conflict over the proper interpretation of the effects of the Droop and Hare quotas. On one hand, the Hare quota is shown to be superior to the Droop Quota because it has no deviation from proportionality and is less sensitive to efficiency because it allocates ballots on higher preferences. Conversely, the Droop quota is said to be superior because Hare wastes the same number of votes as Droop by continuing to allocate votes to candidates that are already assured of election. In doing so, Droop proponents believe that Hare misrepresents when a typical voter would choose to transfer a ballot. In order to understand which is the better choice of quota, we need to examine the presumptions of these arguments.

Certainly, there is no disagreement regarding whether a typical voter would want to transfer her ballot if she knew that her previous choice(s) were already assured of election. Of course she would want her ballot transferred. However, we need to examine whether or not the voting system should allow votes to be transferred before a candidate has attained a quota of votes equal to the proportion of seats available in the election.

It is important to remember that voting is, for the most part, an act of self interest rather than an act of objective assessment. The primary function of the voter is to choose representatives that support her own interests. It is the function of the election system to objectively assess these individual choices and represent them according to their prevalence in the voting community. By voting self interest, voters provide accuracy to the process of choosing representation. By assessing votes objectively, the election system provides fairness to the process of choosing representation. These are opposite, but complementary functions.

Thus, increasing the election system's responsiveness to a voter's wishes is not necessarily synonymous with increasing fairness. The wishes of voters are subjective. The tabulations of the election system must be objective. Justifying the use of the Droop quota because it is more responsive to a voter's wishes is not the same as saying the Droop quota makes STV a fairer system. Responsiveness should not be increased beyond the point where it begins to compromise fairness. The Hare quota is the standard of fairness because it has no deviation from proportionality, and it is less sensitive to differences in efficiency. The Droop quota, while perhaps more responsive to a typical voter's wishes, sacrifices fairness for the sake of responsiveness.

### ***The Divergence Factor:***

A critical flaw in the historical arguments about quota is the focus on the quantity of votes effected by quota rather than on the conditions that affect how efficiently votes transfer. Since we have demonstrated significant differences in voting pattern efficiency, the evaluation of different quotas should focus more on *how fast* quantities change in addition to *how much* quantities change. The demonstrated differences in the efficiency of voting patterns demand that we consider rates of change as well as total quantity of change.

The divergence factor is a rate of change that allows for comparison of how different quotas react to differences in voting pattern efficiency. The divergence factor created by different voting patterns and quotas is quite similar to the divergence factor created by compound interest on a bank account.\* Thus, I will use the bank account example to explain and demonstrate the divergence factor.

***Interest Rates and Voting Patterns:***

I will compare the divergence between two pairs of bank accounts. Each separate account will contain one thousand dollars. The first pair of accounts will earn interest at rates of 5% and 10% respectively. The second pair of accounts will earn interest at rates of 20% and 25% respectively.

The difference in the interest rates of the two pairs is equal to 5%. Within each pair, we can expect the account with the higher interest rate to grow faster than the account with the lower interest rate. Thus, the accounts in each pair will diverge, or grow apart from each other. More importantly, as both pairs diverge over time, the rate of divergence will be higher in the pair of accounts with the highest overall magnitude of interest rates. In order to demonstrate this effect, let's assume that each account is compounded five times at the interest rates given above. Figure 8.11 illustrates this effect:

Figure 8.11 Divergence of Bank Accounts

<i>Low Pair</i>	<i>High Pair</i>
10% = \$1,611	25% = \$3,052
5% = \$1,276	20% = \$2,488
<b>Divergence @ 5% = \$335</b>	<b>Divergence @ 5% = \$564</b>

The effect of compounding is clear. Although each pair began with the same difference in interest rate, (5%) the pair of accounts with the highest interest rates exhibited a higher rate of divergence than the pair of accounts with lower interest rates. Thus, we know that there is divergence in a pair of accounts if one account has a higher interest rate than the other. Moreover, we know that as the overall magnitude of the interest rates for a pair of accounts increases, the rate of divergence between two accounts will also increase, even though the relative difference in interest rates between each pair of accounts is the same.

All STV elections, regardless of the quota used, exhibit divergence between candidates. This divergence takes place as candidates receive transfer votes throughout the counting process. The rate of divergence is effected by the relative efficiency of the voting patterns and by the definition of quota, just as the rate of divergence in the bank account

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\* While the idea that rates of transfer are more important than quantity of transfer are my own, much of the credit for describing these rates of change as interest rates belongs to Robert Winters, Associate Professor of Mathematics at Wellesley College and fellow junkie of Cambridge elections.

example is affected by the relative difference in interest rates and the overall magnitude of the interest rates.

Differences in the efficiency of voting patterns are comparable to relative differences in interest rates. I have already provided evidence indicating that the voting patterns of higher status constituencies tend to be more efficient than the voting patterns of lower status constituencies. This is true because higher status constituencies tend to vote longer, more uniform ballots. Although we cannot assign specific values to represent the difference in efficiency between voting patterns, we can say that higher status constituencies will have a relatively higher interest rate than lower status constituencies. This is explained in more detail in the subsection *Why Vote Totals are Similar to Bank Accounts*.

Similarly, the difference between Droop and Hare is comparable to the difference in overall magnitude between two pairs of bank accounts. The Droop quota produces a higher rate of interest for all constituencies in the election. Conversely, the Hare quota produces a lower rate of interest for all constituencies in the election. This is true because the Droop quota increases the proportion of votes transferred in an election. Although the efficiency of voting patterns governs the relative interest rate of a given constituency and therefore candidate, the quota definition governs the overall magnitude of the interest rates in an election. This is explained in further in the subsection *Why Quotas Change Interest Rates*.

In order to illustrate the effects of divergence in an ordinal election, figure 8.12 applies the effect demonstrated in the bank account example of figure 8.11. The plus signs indicate the relative values of interest rates and divergence.

Figure 8.12 Divergence of Candidates

Hare		Droop	
High Efficiency	++	High Efficiency	++++
Low Efficiency	+	Low Efficiency	+++
<b>Divergence</b>	<b>= +</b>	<b>Divergence</b>	<b>= ++</b>

As stated before, we cannot know exactly what interest rates would represent the efficiency of the voting patterns in question. However, we do know that higher status constituencies will have higher interest rates than lower status constituencies. Similarly, we cannot know exactly what increase in magnitude would represent the effects of the Droop or Hare quotas. However, since the Droop quota allocates more transfer votes than the Hare quota, we know that the Droop quota would produce a higher overall magnitude than the Hare quota.

While both quotas produce divergence between candidates based on the differences in the voting patterns between lower status and upper status constituencies, the Droop quota produces a higher rate of divergence than the Hare quota. This is due to Droop's increased sensitivity to efficiency.

### *Why Vote Totals are Similar to Bank Accounts:*

Vote totals of candidates in an STV election act like bank accounts. They earn interest paid in transfer votes. However, the amount of interest earned is not solely a function of the number of votes in their account. Rather, it is more a function of how efficiently their supporting constituencies vote. Based on the hypotheses of Chapter 6, we can expect candidates supported by higher status constituencies to earn more transfer votes in interest than candidates of lower status constituencies.

In order to demonstrate interest rates more clearly, assume two candidates are tied with a vote total of 1,000. The first candidate is supported by higher status voters while the other is supported by lower status voters. The next candidate to be counted out has a total of 500 votes. The first 250 are from higher status voters while the second 250 are from lower status voters. Assuming all issues of particular association are held constant, interest rates will decide which candidate is ahead at the end of the transfer.

Since higher status constituencies are more uniform in their expressions, we can expect that their votes will transfer to a relatively smaller number of candidates. Conversely, since lower status voters are less uniform in their expressions, we can expect that their transfer votes will spread out among a relatively larger number of candidates. While each constituency has a pool of 250 votes, the lower status constituency divides their 250 between more candidates than the higher status constituency. In this manner, the higher status candidate earns more transfers.

Moreover, the affects of classism, (votes moving toward the center in figure 6.3) would make it likely that the candidate supported by higher status constituencies would pick up a number of transfers from the lower status voters. It is less likely that the candidate supported by lower status constituencies would pick up any votes from higher status voters. Thus, higher uniformity creates a larger number of transfer votes awarded.

The same result happens when considering the efficiency created by the amount of utility expressed. Assume the same example; each candidate has a potential transfer of 250 votes. We can reasonably assume that some ballots from each constituency will end up exhausted after the transfer. Since lower status voters tend to express fewer preferences, we can expect that the 250 votes of the lower status constituency will have a higher exhausted rate. While 225 of the higher status votes may be transferred to other candidates (25 exhausted), perhaps only 200 of the lower status votes will be transferred to other candidates (50 exhausted).

Thus, the sum of the two effects (efficiency) create the difference in transfer interest rates. Higher status constituencies are likely to allocate more ballots among a narrower field of candidates. Conversely, lower status constituencies are likely to allocate less ballots to a wider field of candidates. Thus, the interest rates of candidates supported by higher status constituencies will be higher than the interest rates of candidates supported by lower status constituencies.

Suppose the competing candidates were supported by the same constituency. Would there still be divergence between these two candidates? The answer is yes. Votes are transferred by moving to the next preference expressed each ballot. As ballots are transferred and/or re-transferred with each candidate that is declared defeated, ballots that do not become exhausted are allocated on increasingly deeper preferences. In Chapter 5, I demonstrated how the concept of diminishing marginal utility affects the preferencing process. The further down in the preferencing process, the more arbitrary are the distinctions between candidates listed. As more preferences are expressed, the ranking process will be increasingly effected by name recognition and classism and less effected by definitive measures of representativeness.

This increasing rate of arbitrary decision in the preferencing process also affects the divergence between two candidates, even if they are supported by similar constituencies. As ballots are allocated on increasingly deeper preferences, candidates perceived as more powerful or more well known will gain a larger proportion of the transfer votes. Allocating on increasingly deeper preferences provides a particularly important advantage to incumbents.

Thus, the differences between the interest rates of candidates in an STV election are defined by two factors. First, the efficiency of the constituencies supporting the candidate affect the interest rate of a candidate. Second, how well known or how powerful a candidate is perceived to be affects the interest rate of a candidate.

Because of these two factors, each candidate in the race can be ranked according to his relative interest rate. Candidates supported by higher status constituencies will largely be ranked higher than candidates supported by lower status constituencies. Candidates supported by a mix of constituencies will be somewhere in the middle.

Similarly, the most popular and well know candidates, particularly incumbents, are likely to be higher in their respective groupings than less well known candidates. There are no definitive lines, however. A well known candidate represented by lower status constituencies may have a higher interest rate than a relatively unknown candidate supported by higher status constituencies.

As the election count progresses, candidates collect votes based on their interest rates. Like the bank accounts in the example of figure 8.11, candidates with higher interest rates will grow faster than candidates with lower interest rates. Thus, there will be growth in the divergence between all candidates in the race. Candidates with higher interest rates will pull away from candidates with lower interest rates after each successive transfer. Divergence takes place in any STV election, regardless of the quota used.

### ***Why Quotas Change Interest Rates:***

If all STV elections will experience divergence regardless of quota, what role does the quota play in divergence? In the bank account example of figure 8.11, I stated that changing the quota simulates the affect of changing the magnitude of interest rates between two

accounts. Although the difference in interest rates between the two accounts remained the same, increasing the magnitude of the pair resulted in greater divergence. In other words, quota defines the rate of divergence between candidates. The Droop quota creates a faster rate of divergence than the Hare quota.

The Droop quota creates a faster rate of divergence than the Hare quota through two effects. First, the Droop quota increases the total number of ballots transferred in the election, relative to the Hare quota. Second, the Droop quota forces transfer ballots to be allocated on deeper preferences, relative to the Hare quota.

When a candidate reaches quota and is declared elected, two events happen. First, the number of candidates competing for transfer votes decreases by one. Second, the number of votes available for transfer decreases. Candidates reach the Droop quota faster simply because it is smaller. Therefore, the number of candidates receiving transfer votes decreases faster when using the Droop quota. Moreover, since the Droop quota is smaller, each elected candidate removes a smaller portion of votes from the total number of votes available for transfer. Thus, the Droop quota leaves *more votes* to be allocated among *fewer candidates*, as compared to the Hare quota. This creates the effect of increasing the magnitude of interest rates for all candidates in the election. Consequently, it increases the rate of divergence between candidates with different interest rates.

Having more ballots to be allocated among fewer candidates requires that ballots be allocated on deeper preferences, relative to the Hare quota. This is why the Droop quota is much more sensitive to efficiency in voting patterns than the Hare quota.

The increase in the rate of divergence created by the Droop quota means that candidates with higher interest rates will pull further ahead given the same number of transfers. Consequently, the ability of minority constituencies to combine their electoral power towards the election of a representative decreases faster with Droop than it does with Hare.

### ***Quota and the Rate of Exhausted Ballots:***

This chapter already demonstrated that the Droop quota will leave a predictable number of ballots exhausted at the end of an election. Similarly, we know that ballots can become exhausted under the Hare quota. What I will discuss now is the rate of exhaustion under each quota and how this affects which ballots are more likely to end up in the exhausted pile at the end of the election.

Clearly, an election for nine seats is over when there are ten candidates left in the race. The candidate in tenth place is declared defeated, counted out and the nine remaining candidates are elected, regardless of when or if they achieved quota. Although a large number of the ballots left by the tenth candidate will be counted as exhausted at the end of the election, it is the ballots that were exhausted before the tenth place candidate is counted out that have the most impact on the outcome of the election.

The total number of exhausted ballots left at the end of the election remains a reliable indicator of the overall deviation from proportionality. However, it does not indicate the direction of the deviation. In other words, a deviation from proportionality indicates that some constituencies did better than they should have while others did worse than they should have. By itself, deviation from proportionality does not indicate which constituencies got robbed and which got a bonus. It only indicates the size of the robbery that took place.

Since the Droop quota forces transfer votes to be allocated on deeper preferences, it creates a greater propensity for ballots to be exhausted before the final count of the election. Moreover, since lower status communities vote shorter ballots, a disproportionately high number of the exhausted ballots accumulated before the final transfer will come from lower status voters. Thus, the Droop quota makes it more likely that lower class constituencies will be left holding the total bag of exhausted ballots at the end of the election.

### ***Refuting the Historical Support for Droop Quota:***

Two critical elements are missing from the historical evaluations of the Droop quota. The first is an understanding of the differences associated with ordinal and categorical ballots. The second is an understanding of how social factors effect ordinal voting patterns.

History shows that Droop proposed his quota at a time when the list system of PR was far and away the most popular form of PR in use. Since list system PR is a categorical voting system, using the Droop quota had no effect on the proportionality of the results. Rather, it was shown to increase the full allocation of seats while reducing the amount of remainder votes. This more complete allocation was widely viewed as an increase in the fairness of the election.

This perception seems to have carried over to the use of the Droop quota in STV elections. Like its affect on the list system, the Droop quota used in STV fully allocates more seats than Hare. In the absence of consideration for the differences associated with ordinal and categorical ballots, the use of Droop for STV elections seemed a great improvement. To be sure, the ability to end the election with more, if not all, of the elected officials reaching quota added an air of certainty and unquestionability to the results of elections. No one seemed to question whether certainty was truly synonymous with fairness.

Indeed, we must consider the perceptions of the time in order to understand why the complete effects of the Droop quota were not considered. At the time that the Droop quota was proposed, voting was not considered the universal right it is largely considered today. The exclusion of women, minorities, the poor and the less educated was commonplace in elections at the time the Droop quota became popular. It was not necessary to question how the change might affect different constituencies because those allowed to vote were often a largely homogeneous group at the start. Clearly, the range of constituencies that require the consideration of fair representation has grown considerably since the time of Droop.

Thus, the fact that ordinal ballots introduce a changing rate of efficiency previously excluded from categorical elections was overlooked when the Droop quota was adopted for both STV and list PR. Moreover, the importance of gender, race, social position and other cultural factors were largely unappreciated as determinants of fair representation until relatively recent times.

In more recent years, proportionalists have focused on comparing PR to plurality elections. Since any system of PR is more equitable than a plurality election, the class bias associated with Droop and STV has largely been overlooked as an insignificant issue. Thus, the normative arguments supporting the Droop quota have remained largely unchallenged and, consequently, unchanged for more than a century.

***The Mathematical Argument for Droop Quota:***

As stated earlier, the Droop quota rewards efficiency in its results. The Droop quota allocates more seats than the Hare quota because it requires less votes per elected candidate. The mathematical argument for Droop asserts that a highly organized political party can use the efficiency inherent in the Droop quota to gain a majority of seats with a minority of votes if the Hare quota is used. Figure 8.13 presents the example used by Hoag and Hallett (1926).

Table 8.1 Election of Five Candidates on 100 ballots

<b>Hare Quota = 20</b>				<b>Droop Quota = 17</b>			
<i>Party X</i>	#1 Votes	Transfer	Result	<i>Party X</i>	#1 Votes	Transfer	Result
x1	51	31	20(elected)	x1	51	34	17(elected)
x2	0	+20	20(elected)	x2	0	+17	17(elected)
x3	0	+11	11(defeated)	x3	0	+17	17(elected)
x4	0		0(defeated)	x4	0	0	0(defeated)
x5	0		0(defeated)	x5	0	0	0(defeated)
<i>Party Y</i>	#1 Votes	Transfer	Result	<i>Party Y</i>	#1 Votes	Transfer	Result
y1	17	0	17 (elected)	y1	17	0	17(elected)
y2	17	0	17 (elected)	y2	17	0	17(elected)
y3	15	0	15 (elected)	y3	15	0	15(defeated)
y4	0	0	0 (defeated)	y4	0	0	0(defeated)
y5	0	0	0 (defeated)	y5	0	0	0(defeated)

In both examples, Party X holds the majority of total of votes (51) while Party Y holds a minority of total votes (49). Using the Hare quota on the left shows that two candidates of Party X reached quota and are elected while the third candidate holds the final 11 votes attributed to the Party X. Conversely, no candidate in Party Y was able to reach quota, but the top three were able to gain more votes than the third candidate of Party X. Thus, the party with the minority of votes wins a majority of the available seats.

In the right column, the same vote totals are shown with the Droop quota. The smaller Droop quota forces some votes to be allocated to deeper preferences within Party X.

Thus, the third place candidate in Party X is able to gain enough votes to defeat the third place candidate of Party Y.

Earlier, I considered the argument that the Hare quota wastes ballots because it allows candidates to continue collecting ballots after they are assured of election. This argument takes that point a step further. The "wasted votes" in this example cause the party with fewer votes to win the election because they were successful at spreading their vote around to maximize the totals of three of their contenders.

This is a very good strategy. Since no candidate who achieves the Droop quota can be defeated, the best use of a party's voting strength is to instruct the party voters to limit their support of the most popular candidates to the Droop quota in order to provide extra support for their weaker candidate.

Hoag and Hallett (1926) present the example of elections that took place in the upper house of Denmark's Landsting until 1915. The Hare quota was used and the voters of each party would come together before balloting in order to "divide their first choices into smaller Droop quotas so as to make them go as far as possible." They assert that "without such maneuvers the simple (Hare) quota is practically sure to waste votes on candidates already sure of election without them." Clearly, the argument intends to warn against the Hare quota as a way for a smaller, but better organized party to best a larger, but less organized party (p. 378).

### *Examining the Mathematical Argument for Droop:*

The conclusions of the mathematical argument are overly simplistic. Although the mathematical argument is true as it is presented, it is based on a number of assumptions that reduce it to an impossible theoretical interpretation.

First, the argument assumes that the election is between two competing parties. As stated in Chapter 3, PR provides a great incentive for new parties to represent themselves in the electoral process. It is highly unlikely that 100% of the vote cast in a substantial election would be cast between only two parties. Even a small percentage of independent or third party ballots would significantly decrease the odds of a minority vote total gaining a majority of seats.

More importantly, the model assumes that all transfer votes will stay within the party designated by the first choice candidate. One of the principal advantages of STV and its ordinal ballot is the option to spread out support between many different candidates, regardless of party affiliations. An unknown, but significant number of voters will switch party affiliations at least once, perhaps more, as they assemble their list on an ordinal ballot. Thus, Hoag and Hallett erroneously apply a categorical assumption to an ordinal ballot election.

However, the greatest impossibility of the mathematical argument for Droop concerns the practice of strategically limiting support to the Droop quota in order to create better

efficiency. The questions of free democracy momentarily aside, strategists must first be capable of accurately predicting what the Droop quota would be for the election in question. Thus, they would have to predict voter turnout to an incredibly accurate degree. For example, we know that Cambridge elects nine seats and thus, the Droop quota is 10%. In order to predict the quota within reasonable degree of certainty, say plus or minus twenty votes, strategists would have to predict voter turnout within 200 votes. Turnout in Cambridge elections is higher than average, but routinely fluctuates by 1,000 votes or more. It is not uncommon for election turnout to fluctuate by several thousand votes.

Even more difficult, strategists would also have to convince party candidates that they are capable of accurately predicting quota. Ordinal ballots create a significant level of intra-party competition since candidates compete to gain as many #1 votes from party members as possible. Economic theory states that the inability of an entity to control the allocation of a resource results in the "tragedy of the commons." The fishing industry is a timely example of this theory. Since no one has ever owned the fishing stocks of New England, competing fishers have always sought to maximize their own catch. There was never an incentive to conserve (or distribute) the resource differently because what was left behind would only be picked up by another competing fisher. Thus, fishers would sail everyday with the intention of always catching more than the next person. Any other strategy would only result in going out of business (Tietenberg, 1992, p. 56).

The tragedy of the commons applies to elections, although the results are not tragic at all. Without the ability to absolutely assure party candidates that strategists could accurately predict quota and enforce preordained voting requirements on party members, there would be an overwhelming incentive for candidates of the same party to try and maximize their own vote totals at the expense of other candidates. The tragedy of the commons is the savior of elections. In a true democracy candidates should always have an overwhelming incentive to compete for the support of voters. This is the essential element that keeps elected officials accountable to the public.

Of course, we have not even discussed the issue of how party strategists actually designate which voters should vote for which candidates in order to maximize efficiency. It seems like it would be easier to look out over the ocean and tell the fish which boats to jump into than it would be to tell the voters which candidates they should list. At least the fish would be indifferent to their choice of fisher. Voters are likely to be anything but indifferent to their choices of representatives.

The example of the pre-1915 Landsting in Denmark is a good example of a mathematical anomaly. The Landsting election in question was similar to electing the Speaker of the House and party leaders in the United States Congress. Predicting turnout and quota was easy since the total was limited to the number of representatives in the body. In addition, no right-minded politician would miss a vote on the leadership. Moreover, political party lines were inordinately solid. Thus, the categorical limitation of no party crossover did apply.

However, in a more typical election where ordinary voters are choosing their representatives in a relatively large constituency, the assumptions behind the mathematical argument for Droop are entirely unreasonable. Although it is technically possible for the mathematical argument for Droop to happen by chance, it is likely that the uncertainty of the weather on election day has a more substantial impact on an election than the assumptions of the mathematical argument for Droop. Strategically engineering the assumptions of the mathematical argument is virtually impossible.

### *Defending the Hare Quota:*

The technical arguments against the Hare quota have already been countered in the previous section. However, one basic conceptual question needs to be answered in more detail. A large part of the dissent regarding the Hare quota is its propensity to leave at least one, or perhaps several, seats allocated by less than a full quota of votes.

Since the Hare quota requires each seat to earn a full proportion of votes, one exhausted ballot in the election will make it impossible for one candidate to reach quota. Even when using the Hare quota, it is almost certain that there will be several percentage points worth of exhausted ballots in the election. Therefore, it is likely that several candidates may not reach quota once all the ballots have been fully allocated. Thus, the Hare quota election ends when there are nine candidates remaining, regardless of whether or not some of them reached quota. On the surface, this may appear to be less proportional than the higher allocation rate of the Droop quota. This assumption is incorrect.

The difference is in how each quota defines the role of exhausted ballots in the election. The Droop quota totally excludes exhausted ballots from any role in the election, except providing a distinct advantage to constituencies that are less likely to cast easily exhaustible ballots. In the absence of any role for exhausted ballots, an election of nine candidates under the Droop quota is decided by only 90% of the voters. As stated earlier in this chapter, a nine seat election under Droop always deviates from proportionality by 10%.

This exclusion of a role for exhausted ballots also violates the function of an ordinal ballot. As stated in Chapter 5, an ordinal ballot cannot necessarily be interpreted as expressing an absolute value of zero. Rather, an exhausted ordinal ballot can only be considered a vote of no preference.

Thus, the Hare quota's propensity for leaving a number of seats partially unallocated at the end of the election should not be interpreted as incompleteness. Rather it is a way of including exhausted ballots in the election. While the Droop quota interprets the voter of an exhausted ballot to say "I do not wish to be included," the Hare quota interprets an exhausted ballot to say "beyond the choices I listed I have no preference. I'll wait to see what the other voters think and then I'll agree to support the most favored candidate." Under this interpretation, any of the remaining nine candidates that have not reached quota would be awarded the no preference support of the exhausted ballots.

***Conclusion:***

The question of Hare or Droop boils down to the acceptance or rejection of no preference votes in an ordinal election. In Chapter 5, I previously demonstrated that it is mathematically impossible to say that an ordinal election system cannot include the expression of no preference. The absence of distinct choice is not the same as refusing to show up on election day.

The correlation between educational attainment and ordinal voting patterns proves conclusively that the number of choices listed on a ballot is not random, but is caused by some combination of factors that influence the perception of representation. Knowing this, it is impossible to exclude the possibility of no preference votes without introducing a value based bias into the election system.

Based on the criteria outlined in this chapter, the Hare quota is the natural quota for STV elections. It guarantees the election of the proper number of seats with the lowest deviation from proportionality. The Hare quota achieves perfect proportionality by not excluding exhausted ballots from the process of allocating seats in the election.

The Hare quota is a better standard of fairness for STV elections. It is less sensitive to differences in ordinal voting patterns, making it a more objective assessment of the wishes expressed by the electorate. It is more accurate because it allocates transfer votes on higher, more meaningful, preferences than the Droop quota.

Finally, the Hare quota reduces the rate of divergence between candidates that occurs as votes are transferred. By reducing this rate of divergence, the Hare quota does not allow more efficient candidates to pull out of the reach of less efficient candidates. This ensures that the value of coalition among minority interests has the same value in lower preferences as it has in higher preferences. In other words, it does not penalize voters for expressing coalition at the end of the preferencing process as opposed to the beginning of the preferencing process.

This chapter shows that the Droop quota is inappropriate for use in ordinal voting elections. It applies a 19th century standard of fairness and democracy to 21st century society.

## Chapter 9: The Political Consequences of Changing Quota

### *The Ideal Majority:*

Given an understanding of how the Droop quota introduces bias into the STV election system, how does this bias affect political relationships? This work provides significant evidence showing the Droop quota strongly favors higher status constituencies. The purpose of this chapter will be to outline how the bias associated with the Droop quota affects political behavior.

Although the goal of PR is to elect representation that accurately reflects the proportions of the population, the decisions of the representative body are still a matter of majority rule. Since there are nine City Council seats in Cambridge, five is the magic number. A coalition of five City Councillors holds the power of decision. In examining the political aspects of changing quota, we must consider how quota affects the perception of majority rule.

In her book *Tyranny of the Majority* (1994) Lani Guinier asserts that the American ideal of fairness in majority rule is founded on the assumption that a majority is a fluid coalition capable of redefinition as interests and situations change. In this manner, representatives can move from minority to majority and vice versa based on the circumstances of different situations. When a majority becomes monolithic, the principle of fairness in majority rule is subverted. The minority has no recourse but to suffer under the tyranny of the majority.

This definition of fairness for majority rule provides a context for examining the political consequences of quota. A quota that tends to produce relatively monolithic majorities is less ideal than one that produces relatively fluid majorities. Extending this assumption further, the more politically heterogeneous a representative body is, the more likely it is that the majorities formed will be fluid. Conversely, a representative body that tends to be politically homogenous will more likely produce monolithic, tyrannical majorities.

Based on the evidence of this work, it seems clear that the Droop quota will tend to produce more monolithic majorities than the Hare quota. The Droop quota's relatively high sensitivity to the efficiency of a constituency produces an incentive to suppress political diversity in favor of political homogeneity. As stated in Chapter 8, the Droop quota is the smallest quota capable of electing a given number of seats. Therefore, it is also the smallest quota capable of electing a majority of seats. The Droop quota provides an incentive for coalitions to produce only the smallest amount of political diversity necessary to elect a majority.

The higher divergence factor of the Droop quota also produces a greater tendency for political coalitions to be hierarchical. Because of increased divergence, there is less incentive to present a balanced slate of candidates. Higher divergence penalizes political coalitions that divide their support evenly among all candidates. It rewards coalitions that have clear favorites

and clear underdogs. It perpetuates the power of party favorites while ensuring that others remain strictly as "vote feeders" for established candidates.

The increased divergence of the Droop quota creates a glass ceiling for political interests trying to make the move from futility to feasibility. The rewards of efficiency associated with the Droop quota create an incentive for coalitions to force less established candidates to accept a monolithic political appeal in order to gain acceptance as part of the slate. Less established candidates face the unenviable choice of running without efficient association or taking a place at the bottom of an efficient coalition. From the perspective of minority political interests, the process of political coalition under the Droop quota is limited to choosing the lesser of an assortment of evils.

Using the Hare quota will minimize the incentives for political homogeneity and maximize the incentives for political heterogeneity. It increases the support needed to gain a majority and reduces the divergence rate between candidates. Thus, it creates a greater incentive for political coalitions to include minority interests in their platforms. The lower divergence rate preserves the ability of smaller, less established factions to coalesce effectively, even if done at the end of the allocation process.

Most importantly, the Hare quota reduces the incentive for political organizations to assemble an inequitable hierarchy of candidates. This will reduce the tendency toward polarization and provide an opportunity for candidates to develop a "middle ground" between dichotomous political ideologies. The incentive of a party will be to balance efficient core support with the peripheral support of the minority political interests. The Hare quota reduces the rewards associated with allowing narrow, but powerful interests to dominate a political agenda.

Based on hypotheses of Chapter 7, the change from Droop to Hare will result in a more equitable distribution of power among constituencies of different status. The Droop quota's increased sensitivity to efficiency makes it more likely to give candidates of higher status constituencies the dominant places in the hierarchies' of political coalitions. Conversely, the Droop quota make it more difficult for candidates representing lower status constituencies to gain enough support for election without seeking to coalesce with higher status constituencies.

### ***The Quota in Cambridge Elections:***

The first question many people in Cambridge ask about the issue of quota is "would the faces on the City Council have been different?" A clear answer is not known from the data presented here. However, every one of the past seven elections (and likely more) have ended with significantly more exhausted ballots before the final count than the difference in votes separating the remaining active candidates. Thus, there is a definite mathematical possibility that the results would have been different in these elections, given the use of the Hare quota. Predicting the character of these differences is an entirely different matter. The

conditions affecting the change would begin long before the final count. Thus, predicting the results of the change from the data of the Droop quota count is impossible.

Even recounting the ballots of a past election under the Hare quota would not provide a conclusive answer to the question. Although recounting under Hare may produce changes, the importance of using the Hare quota is not found by examining how it would change the count of ballots cast in past elections. Rather, the significant change would be in the incentives the Hare quota provides to political organizations and candidates in future elections. Over time, the change to Hare would influence the behavior of candidates and political organizations by making them more inclusive of less powerful, minority political interests. Future elections would reward efforts to produce consensus.

### *Quota and Class:*

These goals are particularly important when considering the dynamics of class conflict in Cambridge described in Chapter 2. A change in quota would not result in a realignment of the coalitions and competitions of classes in Cambridge. Rather, it would result in a more equitable distribution of power within existing coalitions.

For example, Chapter 2 included a discussion of the coalition between upper class and working class constituencies. Certainly one would expect that upper class interests are likely to dominate such a coalition based on factors such as efficacy and perceptions of power. The election system that interprets this coalition can either provide incentives that exacerbate or mitigate the tendency toward upper class dominance in a political coalition between different classes.

The Droop quota doesn't necessarily provide incentives to encourage upper class dominance, but it does remove many incentives to mitigate upper class dominance in a political coalition. Conversely, the Hare quota creates an incentive for competing political interests to bargain for coalition with other interest groups. This results in a broader distribution of "clout" within the spectrum of political interests. Under the Hare quota, bigger is more important than efficient. Thus, less organized, less powerful interest groups have more to offer to established political organizations and candidates. Consequently, established organizations will compete in greater earnest for the participation of minority interests.

This does not mean that the patterns of coalition and competition between the different classes in Cambridge will change. It is quite likely that the coalition between upper classes and working classes will remain a solid majority influence. However, this majority will be less monolithic and more fluid. The hierarchical dominance of upper class interests will be reduced. Accordingly, working class interests will gain a new measure of control over the agenda of the coalition.

## *The Sovereignty of Candidates*

In Chapter 2, and thus far in this chapter, I have discussed the interaction of classes as if they were countries negotiating arms agreements; with each group lining up its members on opposite sides of an endlessly long table. In reality, social classes in Cambridge negotiate, coalesce and compete over political differences through candidates for office. Candidates act as the mediators of the endless array of issues that unite and divide residents of different interests.

The Droop quota reduces the sovereignty of candidates since the enhanced role of transfer votes inflates the value of efficient association. Thus, candidates are forced to be disproportionately accommodating to polarized associations at the expense of more diffuse constituencies. Uniformity of position has an increased value while heterogeneous coalition has an increased cost.

The Hare quota reduces the role of transfer votes and thus reduces the value of uniformity relative to coalition. Candidates are less inclined to accommodate polarized associations and are more inclined to assemble more intricate coalitions based on a wider array of values and concerns. A stronger link between individual voters and candidates will be created. More direct accountability of candidates will be established and more diffuse sources of input will be encouraged. The success of candidates will be based more on the broad support of coalition and less on the uniform support of association. The sovereignty of candidates will be enhanced because the system will value candidates of diffuse appeal more than candidates who can closely resemble popular associates.

### *Decreasing "Perpetual" Representation:*

Because of the increased divergence factor created by the Droop quota, Cambridge often experiences what has been called "perpetual representation." Perpetual representation is the uncanny ability of elected officials with questionable support to stay in office, regardless of shifts in public opinion. The increased propensity to allocate ballots on more arbitrary preferences and the overall smaller number of ballots that are actually used to allocate seats under the Droop quota dulls the ability of the election system to react precisely to public opinion. This is caused, in part, by the Droop quota's propensity for allocating ballots on deeper preferences. By using the Hare quota, the system gives higher priority to a voters' primary preferences. This sharpens the system's ability to interpret changes in public opinion and reduces the advantage of simple name recognition enjoyed by incumbents.

Thus, new candidates play a more substantial role in the election process, regardless of their eventual success. The Hare quota removes much of the cushion provided by incumbency and creates greater opportunity for new candidates to play a substantial role in defining the key issues of the election. Since Hare increases the need for coalition, new candidates hold increased leverage over established candidates seeking to maintain a broad base of support.

***Conclusion:***

Changing the quota in Cambridge City Council elections will go a long way to end the extreme divisiveness stifling the political process in Cambridge. Although raising the quota will not change old enemies into friends, it will raise the tax on holding grudges by creating more opportunity for smaller groups and more accountability for dominant groups. Rather than reward the tactics of attrition and deadlock in the policy making process, the Hare quota will create a competition for inclusion and will associate power with equitable cooperation.

Over the last decade Cambridge has been experiencing a pattern of political change that makes the need for the Hare quota more acute. The pace of gentrification over this period of time has destabilized the coalition between upper class and working class interests discussed in Chapter 2. The influx of professional class residents has reduced the upper class' dependency on the working class as a political coalition partner. Armed with the greater ordinal voting efficiency typical of higher status, upper class interests have begun to question the need for coalition in order to maintain political power.

The possibility of the upper class in Cambridge maintaining political power without coalition with the working class is supported by the fact that there is little indication that the relationship between middle class and working class interests is getting stronger. The demographic shifts of the past decade combined with the intensely divisive political climate of present day Cambridge place upper class interests in a position for unprecedented dominance of the political system not seen in Cambridge since before the immigrations of the 19th century.

The Hare quota will not change the demographics of Cambridge or the structure of political coalitions. It will, however, restore incentives to maintain the present coalition structure by providing more political power to working class constituencies. Overall, it will create a more productive and less bitter political climate.

Appendix A: Transfer Sheet of the 1991 Cambridge City Council Election

NAME	First Count	Wolf Surplus	TOTAL	Sullivan Surplus	TOTAL	Under 50	TOTAL	Roquerre	TOTAL	Kurkjian	TOTAL	Hall	TOTAL	Watkins	TOTAL	Spardichino	TOTAL	Sullivan, J.	TOTAL	McSweeney	TOTAL
Cyr	1223	430	1653	2	1655	3	1658	0	1658	2	1660	4	1664	59	1723	18	1741	22	1763	41	1804
Duchay	1941	357	2298	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Hall	82	2	84	0	84	7	91	3	94	4	98	D	D	D	D	D	D	D	D	D	D
Jones	42	0	42	1	43	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Kurkjian	47	7	54	1	55	5	60	2	62	D	D	D	D	D	D	D	D	D	D	D	D
McSweeney	749	4	753	10	763	2	765	7	772	6	778	17	795	6	801	71	872	90	962	D	D
Myers	1708	337	2045	5	2050	3	2053	1	2054	3	2057	5	2062	45	2107	7	2114	5	2119	35	2154
Noble	984	154	1138	6	1144	4	1148	6	1154	17	1171	4	1175	18	1193	17	1210	47	1257	98	1355
Reeves	1705	374	2079	2	2081	3	2084	2	2086	3	2089	10	2099	23	2122	11	2133	18	2151	24	2175
Roquerre	51	1	52	0	52	3	55	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Russell	1812	30	1842	50	1892	5	1897	4	1901	4	1905	5	1910	2	1912	99	2011	126	2137	161	2298
Spartichino	450	2	452	3	455	5	455	11	466	3	469	478	4	482	D	D	D	D	D	D	D
Sullivan, J.	486	9	495	15	510	0	510	4	514	5	519	8	527	4	531	71	602	D	D	D	D
Sullivan, W.	2478	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Toomey	2232	37	2269	29	2298	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Vellucci	1228	40	1268	29	1297	4	1301	1	1302	4	1306	8	1314	8	1322	72	1394	40	1434	131	1565
Walsh	1470	30	1500	27	1527	2	1529	11	1540	1	1541	14	1555	3	1558	84	1642	204	1846	299	2145
Watkins	146	18	164	0	164	2	166	1	167	6	173	6	179	D	D	D	D	D	D	D	D
Wolf	4131	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Exhausted	0	0	0	0	0	8	8	2	10	4	14	8	22	7	29	32	61	50	111	173	284
Write In	6	1	7	0	7	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Invalid	363																				

Total Valid Ballots = 22,972

Quota = 2,298

E = Elected

D = Defeated

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APRIL 25, 1994

TO THE HONORABLE CITY COUNCIL:

ATTACHED PLEASE FIND, A COPY OF "THE QUOTA QUESTION."  
THIS DOCUMENT INCLUDES AN ANALYSIS OF VOTING PATTERNS IN CITY  
ELECTIONS. IT ALSO FINDS EVIDENCE OF BIAS IN THE EXISTING SYSTEM USED  
TO ALLOCATE SEATS IN CITY ELECTIONS.

SINCERELY,

*David R Goode DMD*  
DAVID R. GOODE

Consent Comm. # 1

S-189

Comm. from David Goode entitled "The Quota Question" regarding the analysis of voting patterns in city elections.

In City Council,

May 2, 1994

*Referred to the Government  
Operations Committee &  
Election Commission  
5/5/94 Copy sent to Government  
Operations Committee (D)  
5/6/94 Copy sent to Election  
Commission (D)*