An Informatics Theory of Effective Democracy
Democratic Wisdom Hypothesis and General Relativity of Democracy
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Abstract: The effectiveness of an individual’s decisions to choose the best options depends on her or his information about the subject and the environment; as a result, the effectiveness of democracies which aggregate these individual decisions depends on the consideration of timely information by citizens. Behind the concept of Democracy there lies an idea that this paper calls the Democratic Wisdom Hypothesis. Based on this hypothesis democratic systems can be considered the best social system for human communities and societies; and consequently, living in a democracy can be considered a human right. However, democratic systems have had many different performances and their effectiveness has not been the same. To describe the level of effectiveness of democratic systems in making the effective decisions this paper proposes the Informatics Theory of Effective Democracy which lets us to compare the effectiveness of democratic systems in a six dimensional space which results in the idea of General Relativity of Democracy.

Keywords: Informatics Theory of Effective Democracy, Information Systems, Effective Democracy, Information Dissemination, Communication Technology, Democratic Decision Making, Citizen Participation, System Modelling, Modeling Democracy, General Relativity of Democracy, Democratic Wisdom Hypothesis

Introduction

This paper is about information processing by citizens, their collective decision making and how they relate to the performance of democratic systems.

Although the idea of the “rule by the people” (demokratia) has a couple of millennia of history behind it, democracy has been more criticized than adapted by political thinkers until recently. The meaning of democracy has been debated both from a normative and practical point of view. Questions about who are the people with the ruling authority, the extent of the rule, and possible methods of implementation have caused disagreements which have made the conclusion of the debates to be far from over (Held 1996, p. 1-4).

From a normative perspective scholars have argued that we should support democracy because it produces desirable outcomes: like respect for essential rights, self determination, moral autonomy, human development and political equality (Dahl 1998, p. 45). It has been said that “the people” must be from specific race or gender, particular class or occupation or have a certain level of wealth (Held 1996). There are questions to be answered about who the people are and what is meant by the rule? The South African regime, for example, had long rested on democratic institutions for its white citizens. The meaning of the rule has been debated extensively and positions varied from the belief that “all should be personally involved” to the “rulers would be chosen by the ruled” and even a lesser level of “rulers are enough to act in the interest of the ruled”. “The answers that people give to these questions depend on their political values (Birch 2001, p. 48)”; however, this paper doesn’t have a normative approach and is proposing a framework to understand the dynamics of the “rule by people” and the effectiveness of such a system as it is related to information flow and knowledge building.

This paper is not about judging the different understandings of democracy. It observes that each implementation of democracy is an experiment with specific level of social wealth, literacy, participation and environmental conditions and tries to model the live relationships between human factors and artifacts in these systems. Such a model can be used to study the impact of changes in each part of the system on the overall behaviour of the system, to study the impact of changes in information dissemination by Internet or the possibility of new voting systems with modern technologies. It is by no means a comprehensive review of the huge amount of literature about the definition of democracy or what the best voting mechanisms are or other aspects of democratic theory.

Effective means doing the right thing which is making the best decision, in this case, and it may be harm minimization or utility maximization or other measures. I will discuss and define the effectiveness based on the Social Choice Theory later in this paper.
Defining Democracy

Democracy has been defined in many different ways. For example, Dahl has summarized what he calls the proposition of populist democratic theory by defining, “An organization is democratic if and only if the process of arriving at governmental policy is compatible with the condition of popular sovereignty and the condition of political equality” (Dahl 2006, p. 37). Schumpeter says, “The democratic method is that institutional arrangement for arriving at political decisions in which individuals acquire the power to decide by means of a competitive struggle for the people’s vote” (Schumpeter 1987) and Barney refers to it as, “Equal distribution of power to judge, decide and act” or “Where citizens are able to participate as equals in decisions about conditions, priorities, how common goods out to be distributed and about the content and enforcement of the public interest” (Barney 2005, p. 152,68).

I propose the following definition of democracy as a feedback system, which is similar in spirit to the previous ones but, different in formulation. The benefit of using this definition is that it looks at democracy as a delegation and control system. This definition emphasizes the idea that democracy is not limited to making decisions for selecting representatives, or participation in referendums, or delegating the power to the governors, but also, implies measuring the outcomes of decisions and making the corrective decisions and performing compensatory action by democratic participants. This definition, moreover, lets us explore the role of collective decision making in many processes of a democratic system.

Definition 1: Democracy

• Democracy is a system of governance that has processes allowing the population to exercise their equal power by choosing, monitoring and controlling the governance of the society.

The exercise of power is most of the time through the delegation of people’s authority, and the extent of direct involvement varies widely from anarchy to meritocracy and democratic elitism (Bachrach 1967, p. 94). But, public decision making to some extent is the common denominator of the minimum requirements of democracy.

Looking at democratic systems from this systemic point of view highlights the role of decision making that happens in multiple stages, and lets us study the behaviour of democratic systems as they are affected by information flow. Information as input is used in feedback control when the population makes some decisions to prevent the predicted harm. Information acquired from the observed performance, is used to judge the resulting outcomes and provide feedback in, for example, elections and concurrent control during the democratic process.

But why should the population make the decisions? From a normative approach, the arguments range from achieving goals like political liberty and equality, moral self development and fairness. According to these arguments democracy is the system of choice regardless of the situational outcomes based on ethical grounds. A different approach argues that democracy can provide the best social utility, satisfaction and efficient decisions.

On the other hand, in the course of human history there have been people who believed their individual decisions, regardless of their acceptance by the people, will be better for the world than any other alternatives. Autocrats could be placed in this category. There have been those who believed that their elite group would lead the society to a better destination if everybody followed their point of view or ideology; moreover, there have been people believing that strict obedience and control, even when enforced by oppressive measures, are more productive than relying on consensus. This category could include Fascists. We also know of those who believed that the best for the society will happen when the state regulates nearly every aspect of public and private behaviour. These are the believers of totalitarianism (Elshattain, 1993).

Humans have been ruled by totalitarians and aristocrats for the vast majority of their history, but the exponential prosperity of mankind is observed in the recent centuries and in countries that have adapted their type of democratic approach. Fortunately, we have enough documented history to learn the lesson that the non-democratic methods of governance of those societies are not effective for people in the long run. The harsh reality of the big mesh of the huge system of inter-related local and international affairs of a society is too complex. In all the methods of governance that don’t rely on aggregation of diverse free opinions, not only do we observe a problem of legitimacy but also, the limits of wisdom and intelligence of individuals or small groups will bring the governing group to its knees. In the twentieth century the antidemocratic fascist, Nazi and communist regimes disappeared and military dictatorships lost their credibility (Dahl 1998, p.1).

So far, no group of “a few” decision makers have been able to perform better than ridiculous, in the long run, when they get disconnected with the enormous processing power of their society. This has been observed in spite of the fact that they have had a large number of brilliant scientists and incredible researchers in their group. The failure of the regime in the USSR and Nazi Germany, as well as other dictatorships and military geniuses like Napo-
leon, including the defeats that we observe in contemporary events may be attributed to this illusion about abilities of small groups or individuals.

Democracy as an example of “collective decision making and control” involves making a group decision, monitoring the implementation and choosing a corrective action. Adopting this system has been one of the major achievements of mankind. Democrats\(^2\) believe that the collective decision making, although known to be slower and more complicated, will be more comprehensive, more mature and less risky. Democratic systems outperform other forms of governance because they make better decisions for the people and because they may be controlled by the people, produce more desirable consequences and are less tyrannical to their citizens (Dahl 1998, p45). Even though throughout history non-democratic systems have achieved wonders like the Great Wall of China, the Egyptian Pyramids, and military inventions implemented without a democratic process, can be regretfully criticized for their exorbitant human and financial costs, low efficiency and lack of effectiveness for people.

This paper models Democracy as a feedback system, looks at an historic example of an ineffective democracy, then defines the effectiveness of democracy and evaluates a hypothesis that captures the argument for democratic systems. I argue that the assumed hypothesis is not always true and then I outline a theory that identifies the parameters that will determine the conditions for the realization of the hypothesis and will explain the degree of effectiveness of a democratic system.

**A Historic Lesson**

Germany in 1931 was in Social and Economic turmoil which caused a sense of urgency. Massive propaganda was used to control the mind of people. Fear of communists was worrying many people and they were ready to choose a lesser evil\(^3\) and wanted to find easy and rapid solutions for the problems.

In November 1932 elections Nazis got a relative majority of 33.6% in the parliament and in January 1933 after some leading German businessmen who financially supported the Nazi Party urged the President to appoint Hitler as the leader of a government, Hitler became the Chancellor of a coalition government formed by the Nazis and the Conservatives. In March 1933, with the help of Catholic Centre Party in exchange for a Reich concordat with the Vatican, Hitler attained the needed two third of the parliament vote for “Enabling Act” that gave the cabinet legislative powers and allowed for deviations from the constitution, while all parties except the Social Democrats voted in favour of the bill\(^4\). In November 1939, with a great 96% registered voters turn out; 95% of voters ratified the withdrawal from the Geneva Disarmament Conference and the League of Nations and the rest is history\(^5\).

The Lesson is that a democracy can be affected and manipulated by a number of factors and can lose its effectiveness reducing it to a level that is close to dictatorship.

**Effectiveness of Democracy and Social Choice**

I will build my definition of effectiveness on the Social Choice Theory. So let’s see what the Social Choice Theory says. John Craven defines the choice set for an individual as his or her selection of the

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\(^2\) People believing in Democracy


\(^4\) The Enabling Act was renewed every four years, even through World War II.

most preferred ones from a set of alternatives. He says, “The individual’s preference between alternatives is itself the result of the aggregation of a variety of different considerations”. He argues that “Social Choice Theory concerns the possibility of combining individual’s preferences to find a social choice set from a set of alternatives” (Craven 1992, p. 24-28).

“Arrow asks whether it is possible to find a method that combines individual’s preferences6 “ (Craven 1992, p. 29-30) and his Impossibility Theorem says that no voting system based on ranked preferences can meet a specific set of seemingly reasonable criteria when there are three or more alternatives. This means that a rational social choice rule is impossible satisfying certain conditions.

But in second half of the past century many scholars have shown that social choice is in fact possible. Amartya Sen, in his Nobel lecture The Possibility of Social Choice argues that, “Impossibility results in social choice theory have often been interpreted as being thoroughly destructive of the possibility of reasoned and democratic social choice, including welfare economics. I have argued against that view. Indeed, Arrow’s powerful Impossibility Theorem invites engagement, rather than resignation. Inconsistencies arise more readily in some situations than in others, and it is possible to identify the situational differences.” (Sen 1999, p349-387).

When decisions are made based on rational thinking they are based on optimal choice; that is, the assumption that a decision maker will choose the option that maximizes some value through information collection, analysis and synthesis. But this is not how the decisions are made most of the time. Herbert Simon has proposed the concept of bounded rationality which observes that people construct simplified models of real situations, based on their understanding or belief and behave rationally with respect to their models (Thompson 1996, p. 278). They use heuristics, which are mental rules of thumb like availability, or familiarity that leads to a speedy decision, and satisfice, which is accepting the first satisfactory alternative even when it is less than optimal (Solomon, Stuart, Smith, Sirsi 2005, p. 153).

**Definition 2: Effectiveness of Individual Decisions**

- The effectiveness of decisions made by individuals is in finding the best “choice set”

Effective participation requires having enough education and knowledge; moreover, it requires freedom of choice, expression, equality and timely information to monitor and the power to enforce corrective decisions7. We should ask, “Is the participation of participants in democratic system effective?”

**A Hypothesis that is not Always True**

As can be heard from Patrick Boyer when he says, “The collective wisdom of a large body of well-informed people most reliably produces the best decisions. Therefore, the consensus deliberately reached by a large, diverse group ought to be trusted more than the conclusions or commands of small, homogeneous group or a single individual” (Boyer 1992, p.1-11). Other than normative grounds for democracy, behind the practical concept of Democracy as was discussed in the introduction, there lies an idea that this paper calls the Democratic Wisdom Hypothesis.

**Democratic Wisdom Hypothesis:**

- The decisions made based on overall collective wisdom of individuals reflects a balanced assessment of circumstances and will outperform any single individual’s or small group’s judgments in the long run, even though each may make mistakes in their judgments8.

For example, Robert A. Dahl says in a two alternative group decision, if the probability of each member’s being right is only a trifle better than .51 in a group of 100, the probability of a majority of 51 being right is 52%. But when the probability of the individual’s being right increases to .6 and a majority of 60 people is formed the probability of this majority to be right is 70% (Dahl 1989, p. 142).

Since individuals’ decisions are the result of aggregation of various characteristics of the alternatives, the intellectual and mental capacity of individuals as well as their knowledge plays a significant role in this hypothesis.

However, as John D. Sterman describes, people have a long list of judgmental errors and biases. They use limited, ambiguous and imperfect information available to them to make the decisions, understand the effects of their decisions and adjust their decisions to align the state of the system. As marvellous as the human mind is, the complexity of the real world dwarfs our cognitive capabilities. The greater the dynamic complexities of the environment, the worse people do relative to potential. Bounded ration-

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6 Arrow’s impossibility theorem says that no voting system based on ranked preferences can meet a specific set of seemingly reasonable criteria when there are three or more alternatives.

7 An example will be remaining an active citizen between elections in a representative democracy.

8 To see the pro and cons of group based decentralized decision making and how it can both reduce the margin of error or look at: The wisdom of crowds: why the many are smarter than...
ality constrains the complexity of our cognitive maps and when mental models don’t include feedback, non-linearity, time delays and multiple consequences we are not able to use them to anticipate the dynamics of the system (Sterman 2000, p. 21-32).

On the bright side, we can reach logical deductions with imperfect information and we have tremendous memory capacity and aggregation. Social choice rule or social welfare function may remove extreme deviations and may reduce the significance of individual preferences and biases that are far from common grounds. Aggregation may not be able to cancel the effect of error in available data, lack of the information, insufﬁcient decision making time, lack of corrective power, limitations of intellectual capacities in this process, or ﬂaws of the voting system itself.

Now we can deﬁne the effectiveness of democratic systems based on the level of their achievement to make the democratic wisdom hypothesis come true.

Definition 3: Effectiveness of Democratic Systems

- The effectiveness of democratic systems is in setting the environment for individual’s effectiveness, relying on collective processing power of citizens, correctly aggregating those preferences and ﬁnding the best “social choice set”.

Because the effectiveness of an individual’s decisions to choose the best options from alternative solutions depends on his or her information about the subject and the environment, the effectiveness of democracies in aggregating the individual decisions depends not only, on selection of proper aggregation systems but also, on the creation, management, retrieval, dissemination, transfer and consideration of timely information. But, since the individuals and their information about the world around them are imperfect, the effectiveness of collective decisions is not flawless and having a democratic process in governance of a society by itself doesn’t guarantee an effective outcome.

Collective decisions and exercise of power by people can be observed in every system of governance, democratic and non-democratic. In democratic systems these decisions should effect the social directions frequently. When the collective judgment of the society decides that the system is far from social choice, the system needs correction and the corrective feedback is communicated through different means of communication including people’s vote. On the contrary, in non-democratic systems the governors lose their power when people decide that they can not tolerate what’s going on by chaotic social reactions and many times these feedbacks result in eventual collapse of the system. That’s why coercion is not enough even for non-democratic governments and they use propaganda and fear of external and internal threats to keep their subjects compliant.

It has been observed that governments use propaganda and mass media to exaggerate or even create unreal threats or make real threats to the society to cause fear and increase the support they get from the public; moreover, some thinkers have criticized the current implementation of democracy by stating that the public opinion can be controlled by illusions promoted by mass media (Chomsky 1989) and people are isolated from real decision making processes; as a result, the complexities of management of the society may have been masked for the public. Democratic systems (in their imperfect implementations) as well as authoritarian systems may use the fear to create enemies to ensure the cooperation of their citizens.

This means the decision made by a democratic system is not necessarily the best from the Social Choice Set. It may not be maximizing the utility as it could be if it were made with sufﬁcient information, knowledge, freedom and proper aggregation system. This imperfection however, by no means can be interpreted as a justification for authoritarian and totalitarian or non-democratic collectivist approaches because the weaknesses of individual’s cognition doesn’t apply only to governed but also to the elite. The systems that rely on elite are even worse in everyway because they make decisions by fewer numbers of overloaded decision makers, with less diversity of knowledge, less freedom of looking at different aspects of the topic and they sometimes use worse aggregation systems.

The authoritarian approach utilizing strict obedience to the authority of a state or organization enforces control through the use of oppressive measures. It deprives itself from the ideas that could be different than status quo and eliminates inclusiveness and produces the inefﬁcient systems observed in history.

It is the Totalitarian approach that tries to manipulate the collective decision making process by single-party state, secret police, propaganda disseminated through the state-controlled mass media, re-

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9 To see the pro and cons of group based decentralized decision making and how it can both reduce the margin of error or look at: The wisdom of crowds: why the many are smarter than the few and how collective wisdom shapes business, economies, societies and nations / James Surowiecki. Imprint New York : Doubleday : 2004.
10 There can be many different way to achieve the same goal therefore we will consider a set of choices that if selected can produce a social state that is desirable. The author owes his attention to this fact to the comments from professor Darin Barney in McGill University.
11 Informatics is primarily concerned with the structure, creation, management, storage, retrieval, dissemination and transfer of information.
12 The dynamics of fear is clearly developed in (Shcharansky ,2004).
striction of free discussion and criticism, the use of mass surveillance, and widespread use of terror tactics to stay in power and as a result gets disconnected from the citizens and loses its legitimacy and legality and leads the society into a destructive direction.

A non-democratic collectivist approach focuses on community and society, and seeks to give priority to group goals over individual goals. But without getting the legitimacy for group priorities from the group’s collective judgment, it leads to dictatorship.

Dictatorships silence the dissident thoughts, but as John Stewart Mill argues, “If all mankind minus one were of one opinion, and only one person were of the contrary opinion, mankind would be no more justified in silencing that one person, than he, if he had the power, would be justified in silencing mankind.” because “the opinion which it is attempted to suppress by authority may possibly be true. Those who desire to suppress it, of course deny its truth; but they are not infallible” (Mill 1956, p. 18). As a result, their faults with lack of correcting opinions are what lead them to decay.

Therefore, the fact that Democratic Wisdom Hypothesis isn’t always true doesn’t mean that collective decision making is inferior to other forms of governance but it encourages the researcher to find out what are the conditions that are required for this hypothesis to come true.

**Democracy as an Open System with Feedbacks**

Democracy has many human and non-human actors influencing each other in a network of relationships. The voting systems are artifacts for aggregating individual choices that in turn influence the way the people express their vote by dictating their dynamics. For example, in a First Past The Post system, human decisions are affected by the possibility of vote splitting and people are shifted toward tactical voting which in turn leads to non-optimal social choices.

The processes and agents interact with each other, each individual gets information from many different sources and goes through a decision making process when evaluating the status of society. The elected government is responsible to serve the citizens according to their will. Figure 1 shows a simplified democratic society by presenting three of the many individuals in that society and their relationships with the social, economic and political environment in their society and with other societies.

![Figure 1](image)

Jane is one of the citizens; the four boxes on the right side of the figure 1 show her processes of information collection, environment evaluation and decision making based on her experience and knowledge. The

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decision is a choice between different alternatives, either in an election or a referendum which works as a feedback in this control system but it is applied to the system with a delay, which is a time lag between these formal feedbacks. She also may be active in giving feedback to the government by passively participating in polls and studies conducted by the government or actively participating by posting her ideas on the Internet or writing and talking or blogging which can be considered a concurrent control of the situation.

To make the decision she must collect information about the topic; we know that humans assimilate and process information relatively slowly and they compute and remember relatively poorly, though the human capacity for information storage seems to be unlimited. We can process information at a limited rate and we are overloaded fairly easily (Thompson 2003, p. 278).

“It is generally accepted that our brain cannot process all the information with which it is bombarded, and that attention is the process that selects which stimuli/actions get access to these capacity-limited processes” (Marois & Ivanoff, 2005, p. 296-305). Attention is a scarce resource (Falkinger 2005), “At low levels of load, the response of the system is approximately linear, and there may be little or no interference between tasks” (Kahneman 1973). “It appears that capacity limits do exist beyond a certain point” (Pashler 1999).

**Axiom 1:**

- A person’s information absorbance capacity in a short interval is constant and finite.

**Axiom 2:**

- The information absorbance from the next increment of information made available to the person is proportional to the individual’s fraction of unused absorbance capacity.

This axiom means that a person who is already absorbing information close to his maximum capacity will not absorb as much from the next increment of information available to him. Let’s assume that the amount of information one can accept (Ia) has a maximum (M) and the rate of acceptance of new information will decrease as the rate of arriving information (I) gets close to that maximum. This is in accordance with the information overload that can be observed in many democracies. The following differential equation relates the amount of information one gets from different resources and the amount she accepts and pays attention to.

\[
\frac{\partial I_a}{\partial I} = K \left( \frac{M - I_a}{M} \right)
\]

**Equation 1**

In the equation above, the Maximum Absorbance per unit of time (M) depends on many factors including social and educational background of the person; also, the coefficient of attention (K) is a representation of the significance of the issue for the person or trust of the person on the system; social maturity and political sensitivity and many other environmental limitations that determine how much attention will be allocated to the issue. Sometimes people don’t pay attention to the information and sometimes they don’t have enough attention capacity to process the information as the rate of information flow grows.

If we solve equation 1, the information accepted will have the following relationship with input information flow.

\[
I_a = M \left( 1 - e^{-\frac{K}{M}I} \right)
\]

Figure 2 shows the accepted information as a function of available information based on different maximum capacities (M) and different coefficients of attention (K).

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14 The aggregation triangle in the figure.
15 The author owes his attention to these channels to Professor Richard Smith in SFU Communications Department.
16 M is a constant and is a presentation of mental capacity at this time. One can increase his Mental capacity to some extend over time and it can be depreciated which is not considered in this first approximation.
Line “A” is for an ideal citizen (who doesn’t exist) his maximum information absorbance rate (M) is much bigger than the rate he is absorbing; therefore, as the available information grows he can absorb it all. “B0” is a person with limited capacity and “B1” is the same person with more interest (K) and “B2” is the same person who has educated and trained himself and is able to find the relevant information among what is available therefore has a bigger capacity (M) to accept information.

As shown in figure 1, the individual accepts information from different sources from media and the Internet and other communication channels. Traditional media which are asymmetric and mostly one way communication channels can persuade the people to accept their version of the stories by filtering and selective broadcast mixed with advertisement and biased data. The people have a passive role as the information is pushed to them and the best they could do is smart filtering of relevant and irrelevant information and intelligently reading between the lines to build their understanding of the situation. They use self filtering to overcome fear which is a factor that makes people not to seek a balanced intake of information and justifies different kinds of censorship in many societies.

Propaganda and advertisement can make the process of finding relevant information among the ocean of available information very difficult and having an information base is not enough to make decisions. The information available to us has lots of unrelated and irrelevant pieces in it. Signal to noise ratio is high because the amount of relevant information we are exposed to is little when we change TV channels or page newspapers and hope for some useful information. In the Internet era, which has its own problems of course, everyone can transmit, acquire and verify news and information first hand.

The Internet and availability of mobile communication and sharp drop of the cost of many bidirectional communication channels has increased the connectivity of typical individuals. Modern technologies let the average citizen search in collective human knowledge base to find the necessary information with more discretion and selectivity. One can hope that with implementation of Semantic Web this selective information pull can be enhanced.

**Axiom 3:**

- The information that a person absorbs contains parts that are directly or indirectly useful for the set of decisions one should make and has parts that are irrelevant.

Each individual creates an information base from the relevant information she absorbs. The following equation is proportional to the integral of absorbed information:

\[
I_s = \frac{S}{S + N} \int I_a \, dt
\]
This can be solved as:

\[
I_b = \frac{S}{S+N} \int M(1-e^{-\frac{K}{M}}) \, dt
\]

Equation 2

In this equation the relevant information base is created from the fraction of the information that can be used in decision at hand. This fraction is the amount of useful Signal in the total absorbed Signal and Noise (S/(S+N)).

People don’t make their decisions completely based on rational analysis of information and fear, imitation (Michard & Bouchaud 2005), fashion, ideology and religion play an important role in the decision making process. The person relates the information and organizes her ideas about the topic and tries to gain the most from the decisions she is making based on her preferences and this requires analytical and critical thinking. However, increase in the amount of information in one’s information base doesn’t have a linear relationship with the probability of making the best choice. Let’s assume that this probability increases as the information base grows. At first a little amount of information doesn’t shed a light on the situation but as the Information base grows, at some point the person starts to understand the situation and the probability of making the right choice rises. However, this probability will just get closer and closer to one; even if the person gathers lots of more information she just never reaches to 100% certainty.

Axiom 4:
- The probability of an individual being able to select the alternatives that are in his choice set maximizing his objectives will increase as he spends time to collect and process more information.

Axiom 5:
- When a person knows very little, is just starting to learn about the situation and alternatives and has a tiny chance to select the best choice set, this probability will increase very slowly by next little information she collects. Her chance of choosing the best alternatives will increase very slowly with the next little information when this probability is reaching 100% and she has collected a lot of information about the topic.

This means that if the person is just starting to learn about the situation and alternatives her selection will not be based on rational selection. As she collects information this chance will grow but she can never be sure. These assumptions in accordance with the logistic learning curve (Son & Sethi 2006) and can be formulated as:

\[
\frac{\partial P}{\partial I_b} = \tau (1 - P)
\]

Equation 3

While we solve the above equation lets assume that there are \( m \) choices out of \( n \) alternatives which will produce the outcome desired. If the individual doesn’t have any information about the problem’s environment and the difference of the outcomes of alternatives, she either will not participate, or the selection will be random and as a result, the probability of making the right choice will be \( m \). As the information gathered increases the probability of choosing the best choice set increases.

This increase depends on how much leisure time \( t \) the individual can spend (Barney 2005, p. 162) on citizenship issues. In this formula \( \tau \) (Tau) presents the capability of the person to analyse the situation rapidly and build knowledge from the information and make the choice and present the slow process that leads to bounded rationality and satisfaction.

\[\text{17 The Author owes the concept of Idea Organization to Professor Linda Harassim in SFU Communication Department.}\]
In the above equation the probability of selecting one of the m options when I=0 and Ib=0 (lack of information) or when t=0 (lack of time for social engagement and information collection) or when Noise is very high or when Tau is close to 0 (lack of knowledge building capacity), is \( \frac{m}{m} \).

Figure 3 shows, the probability of selecting a maximizing choice set when there are 8 options and two of them may produce the intended outcome. At first, when the person doesn’t have any time the probability of making the right choice is \( \frac{2}{8} = 0.25 \); as she spends more time and the person collects more information this probability increases.

Curve “A” in figure 3 shows a situation when signal to noise ratio is one and Curve “B” depicts the situation when only one piece of useful information comes in every 10. This presents how it takes more time and energy to produce knowledge and how the probability of making the best decisions remains low in an environment with uncertainty and propaganda. Insufficient information, limitations of information processing and filtering capacity and complexity of the issue at hand will lead the people to make their decisions based on Bounded Rationality, Satisfice and use different heuristic shortcuts like availability (Taylor 1982, p. 191), familiarity. In democratic systems individual decisions are aggregated by voting mechanisms; however, the result of voting in above mentioned conditions may not be very rational and is susceptible to fluctuation between choices and influence by media.

**Aggregation**

So far we looked at the decision making process as is affected by information absorbance and processing. The democratic system must aggregate the information collected about these decisions to find the social choice set and make a choice.

Let’s assume that two democratic societies in ideal condition (knowledgeable people, unbiased press, well connected societies, rule of law, ….) have a dispute about a land. 35% of people in society “A” like the ideas of a candidate who believes they have to go to war, 31% of them like another candidate believe that the cost of war and the damages caused by it will not justify its gains and want to get that land through direct negotiations and 34% of them believe in a third one who thinks that the cost of war and the damages caused by it will not justify its gain and they must put pressure on society “B” through a third party. It is obvious that the first option is not what the people of this society prefer but if they use “First Past The Post voting system”, country “A” will go to war. The observation in this example is a well known and well documented flaw in Plurality because it ignores a lot of information that can be collected about voters’ preferences (Saari 2001, p. 21). It happens with more than two alternatives and is called Vote Splitting or Spoiler Effect. “Ever since it became common for more than two candidates to contest a seat, it has been obvious that simply to de-
clare the candidate having the highest number of votes may grossly misrepresent the wishes of the voters” (Lakeman 1974, p. 58). There are many solutions for this problem; for example, Ranked Pairs Voting will **not** choose the first option.

In a Relative Majority voting system with uninformed voters and uncertainty, if the \( m \) options that should be in **social choice set** can not join, the vote splitting effect may ruin their chance of being selected and the probability of one of the members of **social choice set** being selected can be even less than \( 1/n \). Although the quest for finding better voting systems is an ongoing effort, societies are not enjoying many improvements that are now possible. The Citizens’ Assembly on Electoral Reform\(^{18} \) in British Columbia is an example of people’s effort to improve the aggregation subsystem.

### Feedback Frequency

The frequency of aggregation through voting determines how rapidly the citizens have the opportunity to correct their probable mistakes and remove infidels\(^{19} \) governments and is a feedback control on the system. The \( \tau \) in figure 1 is a symbol to represent the delay between these feedback solicitations. Feedback to government can also be through polls, surveys, panels and activist group negotiations which are concurrent control mechanisms between elections.

Figure 4 shows while aggregated public opinion shifts slowly governments may follow their ideological agenda and get away from public choice after election.

![Figure 4](image1.png)

Robert Dahl says, “If citizens are to retain final control over the agenda, then elections must also be frequent. The point is that without frequent elections, citizens would lose a substantial degree of control over elected officials” (Dahl 1998, p. 96). Figure 5 shows how more frequent elections may result a closer relationship between government performance and public opinion.

![Figure 5](image2.png)

### Requirements and Parameters of Effective Democracy

Canadian Democratic Audit considers three criteria for assessment of democracy: inclusiveness, responsiveness and Public participation. (Barney 2005, p. 6).

Robert Dahl lists six requirements: elected officials; free, fair, and frequent elections; freedom of expression, alternative sources of information, associational autonomy\(^{20} \), and inclusive citizenship; and three essential conditions: Control of military and

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\(^{18}\) [http://www.citizensassembly.bc.ca/public](http://www.citizensassembly.bc.ca/public)

\(^{19}\) To public preferences

\(^{20}\) The right to form relatively independent associations or organizations
police by elected officials, Democratic beliefs and political culture, and No strong foreign control hostile to democracy (Dahl1998, p. 85, 147).

Larry Diamond has proposed eight dimensions on which democracies vary in quality: rule of law, participation, competition, vertical and horizontal accountability, freedom, equality and responsiveness (Morlino & Diamond 2004, p. 20-31).

By formulating the following theory, I am proposing six information processing related dimensions of effectiveness that should complement the enabling conditions to produce effective results.

**Informatics Theory of Effective Democracy**

- **In a democracy when enabling conditions are met, the degree of the effectiveness of democracy is dependent upon six parameters.**

**Enabling Conditions**

Practical, environmental and procedural parameters, Rule of law, control of military and police by elected officials, vertical and horizontal accountability, Democratic beliefs and political culture, and lack of strong external forces hostile to local democracy are enabling factors and without them democracy will be impossible or short lasting.

**Six Parameters of Effectiveness:**

- **Availability of News and Information**

  As is obvious in equation 4, to have a good chance of making the best choice, citizens need to be able to absorb enough information (I) about the nature of problems and the decision environment. News and information about the changing real world should be instantaneously and simultaneously available to them and systematic propaganda and mind control methods that reduce signal to noise (S/N) ratio should be minimized. The extraordinary advances in Information and Communication Technologies in the past decades have raised hopes regarding the information dissemination and the cluttered and unreliable environment of Internet has caused despair in this regard which are being addressed in Semantic Web and other new initiatives.

  According to Darin Barney, “Information and communication, we believe, are foundational to democracy, and therefore technologies that facilitate these contribute positively to democracy's achievement”; but, “recent technological advances in information and communication capacity are not unambiguously or automatically beneficial to Canadian democracy” (Barney 2005, p.4).

  - **Equality of Opportunity and Freedom to access Information and Choose**

    Society members must have equal right to select any of the potential options and the number of their options (m) should not be limited by force or censorship. Citizens should be able and allowed to freely collect information about different possible alternatives from different sources and express their opinions.

  - **Intellect**, processing capability and leisure time

    Ronald Pennock says, “Literacy and education more generally, are of primary importance for democracy.…. Literacy seems to be more important as a foundation for democracy than were other aspects of modernization”. He argues that education provides literacy and trains people to comprehend the issues and helps to break down traditionalism, and to develop willingness to participate in civic affairs (Pennock 1979, p. 243). Members of the society should have enough attention, trust and interest (K) to public affairs, Information absorbance capacity (M) and leisure time (t) and knowledge building capability (Tau) to process the information, understand the situation, make a wise decision and be capable enough to process and consider the different aspects of issues.

  - **Participation, Diversity and Inclusion**

    When the population of decision makers involved is large and diverse, and the aggregation system includes all different opinions, the decisions made will be more effective and individual mistakes will cancel each other.

    People’s participation is related to the importance of the perceived consequences of the decision, and perceived risks and through this the availability and transparency of information effects the participation. If people are informed, intelligent and knowledgeable about the situation, alternatives and consequences and feel that they can make a difference, they will be more participative.

  - **Timely feedback and the power to correct a wrong choice or deviation from social choice**

21 The capacity for knowledge, the capacity for rational thought especially when highly developed. (Webster)

22 Censorship and filtration will make the fundamental hypothesis irrelevant because individual and therefore collective wisdom will not develop.
People should have the power to rapidly and frequently correct their collective decisions through elections and other methods of effecting the government. The delay in the feedback system will create latencies that let the governments to abuse the delegated power and perform actions that are not necessarily approved by their citizens or may try to do some irreversible actions. These deviations in turn will cause reaction in the population and will cause periodic swing between choices. The governments’ frequent look at their approval rating is an example of such control mechanisms. A fast feedback combined with concurrent control of active citizens may prevent big deviations.

- **Proper aggregation and Responsiveness**

The voting system should give equal opportunity and freedom to citizens and aggregate the individual decisions properly. Different voting systems have different deficiencies but some are more susceptible to problems like vote splitting. The people should be able to give feedback to the elected government in free and fair elections and reforming the old inherited voting system to better systems has positive impact on effectiveness of democracies.

Democratic Wisdom Hypothesis is more probable to be true, if the above mentioned conditions are met; and otherwise, it is far from reality and democratic governance won’t be as effective.

**General Relativity of Democracy**

In this paper, I defined democracy as a feedback control system. I mentioned a hypothesis that is the essence of practical arguments for democracy and defined the effectiveness of individual and public decisions based on Social Choice Theory. I then discussed how freedom of information dissemination and choice, attention, leisure time and intellectual capacity of knowledge building, as well as aggregation systems are influential in the effectiveness of democratic systems. Informatics theory of effective democracy says that the effectiveness of democratic systems not only depends on some enabling conditions but also, depends on six informatics related parameters.

Even for those people who live in societies that satisfy the enabling conditions of democracy, the effectiveness of democratic governance depends on the suitability of these six parameters.

Availability of news and information, equality of opportunity and freedom to access information and choose, intellect, processing capability and leisure time, participation, diversity and inclusion, timely feedback and the power to correct a wrong choice or deviation from social choice, proper aggregation and responsiveness are not binary conditions which are either satisfied or not; they are what we can only approximate.

The malfunctions of democratic systems, like the example I mentioned in the beginning of this paper, are rooted in a lack of enabling conditions and a low level of these six parameters. In some societies that consider their governance systems to be democratic, information is controlled by government or by mass media conglomerates. In some, the level of public education and intellect of citizens is low and their participation is minimal; in others, people are overloaded because they have very little leisure time, equality of opportunity and freedom is less than ideal and citizens’ attention is directed to solving their primitive needs. Governments are not formed with maximum diversification and inclusion. Electoral systems are questionable and governments are not responsive enough; therefore, the effectiveness of systems with regards to major issues that have huge effects on their welfare and social and international affairs are less than optimal and varies from one society to the other.

Figure 7 is a three dimensional presentation of the six variables of the theory when used for evaluating the effectiveness of democracies.
Absolute democracy is a hypothetical system. The actual implementations of democracy vary in effectiveness based on the degree to which the influential parameters are met. The acceptance of this dependency concept suggests a conclusion that I call, "The General Relativity of Democracy," in which I restate that, "Although democracies are in fact better than dictatorships, some are relatively more effective than others and some get a very low score on the effectiveness scale."

References


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Amir H. Ghaseminejad is an instructor in Capilano College Business Administration Department where he teaches Information and Strategic Management, Business Technology Disaster Recovery Planning, Advanced Web Design. He also teaches Operating Systems, Networking, Database design and Object Oriented Programming as well as Marketing and Business Computing in Computer Science and Information Systems and Business Management Departments of Langara College, he has taught Networking and TCPIP in British Columbia Institute of Technology as well. Before coming to Vancouver in Beautiful British Columbia, he has taught Computer Organization and Electronics courses in Sharif University of Technology, Faculty of Electrical Engineering in Tehran, where he got a Master of Science Degree in Computer Hardware and Bachelor of Science in Electronics Engineering. He has many years of experience in management and business and holds many industry standard certifications in Internet Technologies and Operating Systems and Databases. His research interests include Technology and Society interrelationships, Systems Analysis, Databases and Information Management Software. His current research is on "The Impact of Technological Achievements on Implementation of Democracy and The Technological Requirements for Implementation of Participatory Democracy"
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