Electronic Voting Machine

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INTRODUCTION

Electronic voting, as well as Internet voting, is in the process of being incorporated into most democracies in the world. The literature on the topic is abundant as well as the technologies offered. Most of the work, nevertheless, seems to bypass the actual origins of the modern (and current) electronic voting systems (Oudenhove et al., 2001).

BACKGROUND: WHAT IS A DOMINANT TECHNOLOGY DESIGN?

The emergence of a dominant technology design is very important for functioning public services. The citizens must have in mind what is acceptable or not. The perception of a machine as being the way it should be is fundamental; otherwise, the system will not have credibility. For example, we know how a typewriter (and now a computer) has to look like thanks to Remington. It is important to understand that to follow a dominant technology design is not just copying a machine. The importance is the psychological perception of what the machine should be. A vehicle with five wheels will not be described as a bicycle. The same is true of fax devices, flight simulators, and cardiac pacemakers (Murmann & Tushman, 2001). It does not mean that the design is the most efficient, as the case of the QWERTY keyboard illustrates. The dominant technology design for electronic voting machines, as James Utterback (1996) has defined it, was developed in Brazil in the late 1980s and early 1990s. Basically, an electronic voting machine that does not follow the Prudêncio design runs the risk of not being credible as a voting machine.

THE EMERGENCE OF THE PRUDÊNCIO DESIGN IN ELECTRONIC VOTING: THE INTERNATIONAL TECHNOLOGICAL CONTEXT

Electronic voting implies the existence of machines to intermediate the process of individual political choice and the collective choice of leadership. It implies by necessity that the electronic system will be safer, more cost effective, and faster than nonelectronic systems.

Most technologies now implemented in Brazil have been preceded by both theoretical and/or fictional suggestions of electronic voting. Computer-supported voting systems, such as the EMISARI, were operating in 1970 even though they were more predecessors of conference systems than voting systems. Among those involved in theoretical discussions of the 1970s, we have Buckminster Fuller and Tomas Ohlin (Oudenhove et al., 2001).

The first systems to enter operation were off line (Barlow, 2003). In fact, one of the first patents for electrical voting was proposed by Thomas A. Edison in June 1869 to be implemented in the U.S. Congress. Mechanical voting systems were proposed in many parts of the world in the late 1890s and were used in the United States in 1892 at Lockport, New York. When mainframe computers became accessible, they were used for tabulation and vote counting. Punch-card technologies were a common feature of democracies in the 1960s. Mechanical voting machines became dominant in the United States in the 1960s. Off-line machines with card readers were also proposed. Criticisms and fear of fraud favored the introduction of optical readers in some corners of the Earth in the 1970s, but the accuracy problems persisted (United States Federal Election Commission, 1998). A survey in the United States in 1984 indicated that 28% of the systems used for vote counting could generate errors.

The great challenge now is the introduction of online systems as well as mobile telephone systems for direct referendum of proposals by politicians, a form of direct electronic democracy. Online systems have existed since the 1970s for research and survey purposes. One example was the Electronic Town Meeting tested in New York in 1973. The French Minitel system was used also for research and surveys in the 1970s. Informational voting was carried out through the Minitel to survey the needs of the public and improve on public administration. Similarly, telephone surveys and voting by groups of citizens, such as in 1973 at Wuppertal, Germany, were also carried out. With the World Wide Web, all the surveys became, in practice, of general access and participation. Security protocols have made it possible for organizations, even political parties, to carry out elections through the Internet. In 2000, Internet voting was implemented in Alaska, but only 35% of the voters opted for the Internet.

The problems of the 2000 U.S. presidential election gave a global push for electronic election systems. To address the problems and find solutions, the Help America Vote Act of 2002 (HAVA) created a federal commission that is looking into the matter (Wysong, 2004). At the same time the world was wondering about the validity of the U.S. voting system, Brazil was once again carrying out successful electronic elections. The 1998 Brazilian elections had already 57% of the voting population on the electronic systems.

Most of the problems, including the introduction of malicious codes into the voting system, have been surveyed and described in detail by Bev Harris in the book *Black Box Voting* (Black Box Voting, 2005). Most of the issues raised are being addressed by the companies manufacturing the voting machines. Nevertheless, the close association between the leadership of these companies and political organizations has created doubts in the minds of voters. Most of these doubts, if not all of them, are not well founded but must be mentioned. For instance, the most important producers in the United States are Sequoia Voting Systems (2005), Election Systems and Software (2005), and Diebold Election Systems (2005). The key person of Election Systems and Software is Michael McCarthy, who is also a campaign finance director of a U.S. senator. The key person of Diebold is Wally O'Dell, a known important supporter of United States President George W. Bush. Such interfaces between political influential persons and the voting machine producers may raise doubts, although an independent verification service can easily address the issue of credibility.

THE EMERGENCE OF THE PRUDÊNCIO DESIGN IN ELECTRONIC VOTING: THE BRAZILIAN TECHNOLOGICAL CONTEXT

It is interesting that some standard measures taken in Brazil have not been taken in all places in the United States (Internet Policy Institute, 2000; Mercuri, 2002, 2005). The machines are kept secure at all times. Machines cannot be tampered with. Before their deployment, each machine is tested and in addition, there are standby teams to solve problems or even replace machines. The pool workers are properly trained. The machines generate records that can be verified, and the whole process is transparent. That certain problems have occurred in the United States and not in Brazil says more about the nature of the democratic processes in both countries. It is also revealing that the Diebold voting machines that are distributed in Brazil have had no problems, while 14,000 of them had to be recalled in California, United States, in 2004. Further verifiability is being introduced in Brazil, placing the country once again further ahead in relation to the rest of the world (Rezende, 2004).

By 2000, 109 million persons were voting electronically in Brazil in a system that could bypass problems of illiteracy and problems such as the lack or instability of the electricity system. The system is designed to overcome the digital divide. By the October 2002 presidential and general elections, the electronic system had reached all voters, proving that electronic democracy was possible, feasible, and verifiable (Östberg, Santhias, & Cabral, 2002). Throughout the country, 19,000 candidates raced for a public position in a country with an income-distribution nightmare, unequal educational opportunities, and wealth opportunities still open.

The whole process started in the southern state of Santa Catarina in a city called Brusque (Santhias & Cabral, 2002). Santa Catarina has some 5.5 million inhabitants with their roots in Italy, Germany, Portugal, Poland, Africa, Japan, and the Ukraine. The cultural diversity necessarily implies that general solutions have to take into account a variety of factors in order to be accepted. In 1989, a judge, Carlos Prudêncio, assisted by his brother Robert Prudêncio, an informatics expert, created the first machines with the design that is today accepted as the way a voting machine should be. It was tested at the 90th electoral district with 373 voters. The test was carried out without formal authorization of the national bureaucracy. It was an act of civil disobedience that shaped the democratic future to come. After the successful test, Carlos