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MUSEUM VISITOR SURVEY SYSTEM

An Interactive Qualifying Project Report

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Abstract

This project details the methods and technology required to create a more efficient and cost effective visitor survey system for the National Museum of Denmark. Research was performed on available survey methods, existing survey software, and those surveying methods used at other institutions. An informed decision was reached through survey software evaluation, field testing in the museum, and museum staff feedback. Recommendations for implementing an efficient visitor survey system using a software package were provided.

Executive Summary

The gathering and analysis of customer feedback is paramount in providing quality service. This feedback from customers or patrons informs organizations of the general feelings towards the services they provide. The National Museum of Copenhagen had performed visitor surveys in the past with the intention of determining patron's demographic information, reasons for visiting, and overall satisfaction. The museum staff determined that the methods employed in creating, distributing, and analyzing these surveys were not efficient. The goal of this IQP was to investigate and recommend an efficient method of conducting visitor surveys in the National Museum of Copenhagen.

The prior visitor surveys conducted by the National Museum required a large amount of staff commitment both for distributing the surveys and analyzing the results. The survey method used in the past by the museum involved staff asking every other individual (or group) to take a brief paper survey at the exit of a special exhibit. Once visitors completed roughly two thousand surveys, a staff member manually entered the data from all the paper surveys collected into a *Microsoft Excel* spreadsheet. From here, basic statistical analysis was performed such as tabulation of raw numbers and percentages. The ultimate goal of the project team was to provide the National Museum with a comprehensive analysis of their surveying options and to recommend methods to improve the efficiency of their surveying techniques, especially in the realm of survey creation, distribution, and analysis.

Several steps were taken to insure that an informed recommendation was made. While the project team was in Worcester, background research was conducted on survey methods, other institutions, existing survey software, and the National Museum itself. Using information gathered from research of other institutions and software companies, interviews were conducted with marketing and visitors departments of other institutions as well as with sales representatives of software companies. With the knowledge gathered from background research and interviews, assessment and comparisons were made of other institutions and of survey software. This resulted in a

report of visitor survey methods at other institutions and a preliminary software evaluation.

The second half of this project took place at the National Museum in Copenhagen. Preliminary analysis of available survey software determined which software packages were most likely best for the museum. More in-depth analysis of the candidate software packages further aided the decision of choosing one piece of software for the museum. Surveying the staff as well as the patrons of the museum provided valuable information in further narrowing the choice of software. Finally, the project team's own experience of field testing various methods of surveying in the museum proved invaluable in recommending a viable method. These methods allowed us to make a sound recommendation to the National Museum as to their improvement of patron feedback collection.

Before work could begin on survey topics specific to the National Museum, the team researched the history and function of the National Museum itself. From its official conception in 1892 to its current configuration, the National Museum has sought to strengthen the visitor's knowledge and understanding of Danish culture, the landscape, the diversity of different cultures, and the Danish cultural identity.

Once general background information was gathered, research was done on surveying as a whole. Among those surveying topics covered are surveying methods, interviews, kiosk surveys, paper surveys, survey design, limitations, motivation for taking a survey, and surveying with computers. Also included in the background research is a discussion of the surveying techniques employed by other museums and institutions. More specific research was also performed on the various forms of statistical analysis that could be performed by the National Museum on respondent data. The project team also used this knowledge of statistics to analyze aspects of field testing, as will be described later. The final piece of research was done on existing software that is used to create surveys, collect data, and analyze the results. A list of available software packages was compiled, along with their basic capabilities and cost. This provided a strong foundation of surveying topics to begin the project.

In order to present the National Museum with an efficient computerized survey system, a number of deliverables were provided. The first of these was a report of

the surveying methods employed by other institutions. A comparison of how other institutions implement their survey system will give the National Museum some new ideas as to other methods to try, and perhaps how to implement electronic survey systems.

Of those survey software packages discovered during background research, a preliminary software analysis was performed in order to narrow the number of candidate software packages to two. Each of the six candidate software packages was evaluated objectively based on its compatibility with the requirements of the National Museum. The two software packages that scored the best were *Kiosk-in-a-Box* and *SurveyPro 3.0*. These two pieces of software were chosen to be further tested in the National Museum.

Once the list of suitable software packages was narrowed down to two choices, they were tested in the National Museum. Field testing the two software packages provided valuable data that were used to inform us as to the effectiveness, efficiency, and many other aspects of the survey system.

The first round of field-testing involved museum staff interviewing patrons by using a laptop running either *Kiosk-in-a-Box* or *SurveyPro*. The second part of field testing used an independent setup where patrons could take the survey on a computer and enter their responses themselves. The final survey method used was the distribution of paper surveys created using *SurveyPro*. A sample museum survey was provided to which the project team added between two and four questions (depending on the method) to the end. The project team's questions were used to determine patrons' computer usage, survey experience, and survey method preference. The responses were compiled and later analyzed using each of the respective software packages.

The field tests conducted in the National Museum yielded respondent data from the three forms of surveying implemented: interviewing, independent computer use, and paper surveys. The raw results from these tests were compiled and analyzed. In total, 193 patrons were surveyed: 119 were interviewed, 54 took the independent kiosk survey, and 20 took the paper survey. General observations were made during field testing with regards to each method. The interview setup proved to have the most success of the three methods. The staff members doing the interviews had no trouble

getting patrons to be interviewed. The interviewers, in general, had no preference as to which piece of software was better. The next survey method, the independent kiosk setup, yielded mixed results. Motivation to take the survey proved difficult, even when a free museum ticket was offered for taking the survey. Both programs demonstrated flaws with respect to this form of surveying. *Kiosk-in-a-Box* performed better than *SurveyPro* in the independent kiosk setup. The final survey method of distributing paper surveys was done in order to compare the differences between the museum's old method of surveying and a newer, electronic method.

Beyond field testing, a detailed software analysis of the two candidate software packages was also performed. An objective software assessment rubric was devised to further rate each piece of software. This was done by weighting each feature of the software with respect to its importance to the National Museum, then scoring the two candidate software packages accordingly.

The project team's personal experience using the two pieces of software allowed for a detailed report of the advantages and disadvantages of each. Each program took very different approaches with regards to creating, distributing, and analyzing a survey. In creating a survey, the project team found that *SurveyPro* performed better than *Kiosk-in-a-Box* with regards to layout, user help, and overall ease of use. In the respondent data collection aspect, the project team found *Kiosk-in-a-Box* to be the superior program with regards to touchscreen compatibility and appearance. Yet, both programs had serious shortcomings regarding respondents' ability to close the respondent screen and access restricted areas of the computer. In the analysis aspect of each software package, *SurveyPro* performed the best by a considerable margin. *Kiosk-in-a-Box* does not provide its own statistical analysis, but rather stores respondent data in *Microsoft Access* for the user to analyze on their own. *SurveyPro*, on the other hand, allows users to easily create comprehensive analysis reports with graphs, cross table analysis, and statistical correlation reports. A detailed report of the analysis capabilities of each piece of software was compiled.

Finally, a detailed statistical review of the respondent data collected during field-testing was conducted. The data were analyzed using ANOVA (Analysis of Variance) and chi-square tests to determine any statistical correlation between question

responses with regard to survey software, hardware, or methods. Time to complete the survey was the only significantly different outcome between the software packages. With regard to hardware, the touchscreen in use for the independent method with *Kiosk-in-a-Box* was evaluated. It was found that people with more computer experience as well as people from a middle age group found it easier to use the touchscreen. The survey methods of independent, interviewing, and paper were compared to determine if there were any biases evident in the data collected. As with the software, there was a significant difference in the time it took to complete the survey. There was also a significant difference in the respondents' answers to their survey method preference and computer experience with each method. Although some conclusions could be made from the data collected in field-testing, it was determined that the sample size was too small to have statistically significant results.

Tutorial sessions were held with the main museum staff member in charge of visitor surveys, Karin Andreasen. Karin was walked through the steps of creating a survey and analyzing the results using both *SurveyPro* and *Kiosk-in-a-Box*. Her input was very valuable as a staff member who may be using the recommended survey software in the future.

After very careful consideration, the project team has chosen to recommend to the National Museum *Apian SurveyPro 3.0*. The key factors in this decision were the evaluation using the software evaluation rubric evaluation, reports from the interviewers, information sessions held with Karin Andreasen, and the project team's own personal experience having worked extensively with the software on a daily basis. Although *SurveyPro* has some shortcomings, especially in the realm of independent kiosk testing, it suits the needs of the National Museum very well.

SurveyPro may be used in all forms of visitor surveys conducted by the National Museum, namely paper and pencil surveys, interviews, and an independent kiosk setup. First, *SurveyPro* can both expedite and facilitate the process of conducting visitor surveys using the paper distribution method. Paper surveys can be made using the program, and results can be manually entered for data analysis. The disadvantage in using this method is the time commitment in data entry of the answers to the paper surveys. Using *SurveyPro* in an interview setting has the advantage of keeping face-to-

face contact with patrons, but also using the software to analyze the interview responses. However, in this method biases are introduced and a staff member must commit as much time as it takes for a visitor to complete a survey in the paper and independent methods plus extra time for visitor feedback. Finally, an independent kiosk setup can be used where museum patrons take a survey independently at a computer station running *SurveyPro 3.0 DirectCollect*. It must be noted that, in its current state, *SurveyPro 3.0* is not entirely adequate for use in a kiosk setting. Apian Software is, however, working to correct problems encountered with *SurveyPro* in an independent kiosk setting. The largest advantage of using an independent kiosk setup for conducting visitor surveys is the fact that no staff members are required to administer surveys or enter respondent data.

After fourteen weeks of research and testing of various survey techniques, the project team recommended a possible implementation for an upgraded, more efficient survey system for the National Museum. The system is cost effective, provides easy survey creation, administration and analysis capabilities, and can be used in a variety of survey settings.

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Table of Contents

Abstract.....	ii
Executive Summary	iii
Acknowledgements	ix
Table of Contents	x
List of Figures.....	xiv
List of Tables	xv
List of Tables	xv
INTRODUCTION.....	1
Project Flow Chart	4
BACKGROUND	5
The National Museum	5
Objective of the Museum.....	5
History of the National Museum.....	5
Structure of the Museum.....	6
Surveying	7
Selecting a Method	7
Types of Survey Methods	9
Interviewing Techniques.....	9
Kiosk Surveying Techniques	10
Paper Surveying Techniques.....	11
Designing and Implementing a Survey.....	12
Survey Limitations.....	12
Motivation for Survey Taking	13
Surveying with Computers	14
Surveying at Other Institutions	15

Statistical Analysis	18
Survey Software	22
Survey Software Features	22
Companies, Software, and Features	24
Hardware Platforms	26
METHODOLOGY	28
Deliverables	28
Report of Surveying Practices at Other Institutions	28
Analysis of Existing Survey Systems and Software	29
Software Pre-assessment	30
Software Field Testing	30
Museum Staff Feedback	31
Testing Setup	31
Conducting Field Tests	33
Analyzing Field Test Data	34
Final Selection	34
Training	35
Knowledge of Software	35
RESULTS	37
Raw Data.....	37
Observations.....	40
Interviewing Method.....	40
Independent Method	40
Paper Method	41
ANALYSIS AND DISCUSSION	43
Software Assessments	43
Pre-assessment Results	44
Survey Creation	45
Respondent Program.....	49
Software Analysis Capabilities.....	51
Survey Data Analysis.....	53
SurveyPro 3.0.....	53

Kiosk-In-A-Box	59
Analysis of Computer Related Survey Questions	59
Software	60
Hardware.....	63
Methods.....	66
Software Functionality Assessment Summary	79
RECOMMENDATIONS.....	82
Software Selection.....	82
Implementation	84
Paper Surveys.....	85
Interviews.....	86
Kiosk	87
CONCLUSION	89
APPENDICES.....	90
A1 Institutions Researched	90
Institutions Researched	90
Sample email to Institutions.....	90
Interview with Institutions	91
A2 Software Pre-Assessment	91
Software Pre-assessment Tables	91
Software Evaluation Rubric	95
Rubric Definitions.....	100
A3 Survey Questions.....	102
Questions for Software Field Testing (all versions)	102
Questions for Independent Setup	103
Questions for Interview Setup	104
Questions for Paper Survey	104
A4 Answers to Questions.....	105
Answers to Questions	105
A5 Interview Reports.....	109
Questions to the Interviewer about interviewing process	109
Interview summary with Anne Bashida.....	110
Interview summary with Karin Andreassen	111

Interview summary with Kitt Boding	112
A6 Software Training	114
Tutorial Sessions	114
A7 Analysis Plan	116
REFERENCES	148

List of Figures

Figure 1: Project Flow Chart.....	4
Figure 2: Decision for choosing mode, mean, or median (Arsham, 2003).....	19
Figure 3: Floor plan of the National Museum denoting testing locations	32
Figure 4: Results of survey preference	38
Figure 5: Results of computer use	38
Figure 6: User interface for <i>Kiosk-in-a-Box</i> survey creation editor	46
Figure 7: User interface for <i>SurveyPro</i> survey creation editor	47
Figure 8: <i>SurveyPro</i> wizard approach.....	48
Figure 9 <i>Kiosk-in-a-Box</i> respondent screen.....	49
Figure 10: <i>SurveyPro 3.0</i> respondent screen (note small radio buttons to left of text)	50
Figure 11: <i>Kiosk-in-a-Box</i> data format in <i>MS Access</i>	52
Figure 12: Sample of <i>SurveyPro 3.0</i> analysis screen.....	53
Figure 13: Sample <i>SurveyPro</i> executive summary table (single choice)	54
Figure 14: Sample <i>SurveyPro</i> executive summary table (question group).....	54
Figure 15: Pie chart displaying the postal code breakdown of guests that live in Denmark	55
Figure 16: Bar graphs showing the postal code breakdown of members of the Museum Club (left) and non-members (right).....	56
Figure 17: Bar graph displaying the mean score of the museum services broken down by respondents' likeliness to return	57
Figure 18: Table showing the 95% standard error of mean and the chi-squared significance measure.....	57
Figure 19: Bar graphs showing the age breakdown of members of the Museum Club (left) and non-members (right).....	58
Figure 20: Bar graphs showing the age breakdown of members of the Museum Club (left) and non-members (right).....	58
Figure 21: Pie chart of results to Q2.....	105
Figure 22: Pie chart of results to Q3	106
Figure 23: Pie chart of results for Q6.....	107
Figure 24: Pie chart of results for Q10.....	108

List of Tables

Table 1: Institutions contacted	16
Table 2: P-value Interpretations.....	21
Table 3: Average survey completion time	39
Table 4: Results of comfort during interview	39
Table 5: ANOVA of time versus software with independent method.....	61
Table 6: ANOVA of time versus software for interview method.....	62
Table 7: Results of ease of touchscreen use versus computer experience	64
Table 8: Results of age versus ease of touchscreen	65
Table 9: ANOVA of method versus time	67
Table 10: ANOVA results for analysis with <i>SurveyPro</i> between methods	67
Table 11: ANOVA results of the analysis with <i>Kiosk-in-a-Box</i> between methods.....	68
Table 12: Results of survey preference versus survey method.....	69
Table 13: Results of survey method versus computer experience	70
Table 14: Results of computer survey experience versus survey preference for independent method.....	71
Table 15: Results of computer survey experience versus survey preference for interview method.....	72
Table 16: Results of computer survey experience versus survey preference for paper method.....	72
Table 17: Results of survey preference versus computer experience for independent method.....	74
Table 18: Results of survey preference versus computer experience for interview method	74
Table 19: Results of survey preference versus computer experience for paper method ..	75
Table 20: Results of age versus computer experience for independent method.....	77
Table 21: Results of age versus computer experience for interview method	77
Table 22: Results of age versus computer experience for paper method	78
Table 23: Software evaluation raw scores based on assessment rubric.....	80
Table 24: Weighted decision matrix for software assessment.....	81
Table 25: Institutions contacted	90
Table 26: Sample table of surveying methods at other institutions	91
Table 27: Preliminary Software Comparison Matrix.....	91
Table 28: Preliminary Software Comparison Matrix (cont.)	92
Table 29: Binary Dominance Matrix	93
Table 30: Weighted binary matrix scores	94
Table 31: General category.....	96
Table 32: Survey creation category	98
Table 33: Survey response category	99
Table 34: Survey analyzer category.....	100
Table 35: Results of Q5	106
Table 36: Results of software versus computer experience.....	116
Table 37: Results of software versus survey preference.....	118
Table 38: Results of software versus computer experience.....	119
Table 39: ANOVA for time versus software for independent method.....	119

Table 40: ANOVA for time versus software for interview method	121
Table 41: Results of touchscreen use versus computer survey experience	122
Table 42: Results of ease of touchscreen and computer experience	122
Table 43: Results of ease of touchscreen versus survey preference	124
Table 44: ANOVA of time versus ease of touchscreen use.....	126
Table 45: Results of touchscreen use versus ease of touchscreen	126
Table 46: Results of touchscreen use versus computer experience	127
Table 47: Results of age versus touchscreen use	128
Table 48: Results of age versus ease of touchscreen	129
Table 49: ANOVA for time versus survey method	130
Table 50: ANOVA results for analysis with <i>SurveyPro</i> between methods	131
Table 51: ANOVA results of the analysis with <i>Kiosk-in-a-Box</i> between methods	131
Table 52: Results of age versus survey method.....	132
Table 53: Results of survey method versus computer survey experience	132
Table 54: Results of survey preference versus survey method used	134
Table 55: Results of survey method versus computer experience	134
Table 56: Results of computer survey experience versus survey preference for independent method.....	136
Table 57: Results of computer survey experience versus survey preference for interview method.....	137
Table 58: Results of computer survey experience versus survey preference for paper method.....	137
Table 59: Results of survey preference versus computer experience for independent method.....	138
Table 60: Results of survey preference versus computer experience for interview method	139
Table 61: Results of survey preference vs computer experience for paper method	140
Table 62: Results of age versus survey performance for independent method	142
Table 63: Results of age versus survey performance for interview method.....	142
Table 64: Results of age versus survey performance for paper method	143
Table 65: Results of age versus computer experience for independent method.....	145
Table 66: Results of age versus computer experience for interview method	145
Table 67: Results of age versus computer experience for paper method	147

Introduction

For businesses and organizations of all types, understanding the wants and needs of the customer is essential to providing quality service. If an organization is providing a service to customers, feedback is paramount so that the organization may better adapt to meet the needs of the customer. Thus, such an organization must possess a reliable and efficient method of retrieving and analyzing customer feedback. Efficient feedback collection provides the point of view of the customer while eliminating the overhead caused by inefficient methods. The consequences of poor feedback collection include inflated costs, lost time, and an increased delay in feedback. The National Museum of Denmark hoped to streamline their patron surveying methods into a more efficient and cost-effective system.

The Danes pride themselves on their rich heritage and cultural achievements. The National Museum offers a terrific forum for the public to experience and reflect upon the history of their country. This is best described in the museum's mission statement, "The National Museum shall provide a basis for societal and individual understanding of Danish culture and of world cultures in all their diversity, changeability and mutual dependency" (Hvass, 2001). In an effort to deliver extraordinary, educational exhibits that will benefit the public, the museum has implemented a survey system to ascertain the desires of the public. The National Museum sought to modernize their paper survey method into an integrated computerized survey system.

The National Museum gathered museumgoers' feedback using paper surveys distributed by the staff as well as face-to-face interviews. When roughly one thousand surveys were completed, a staff member manually entered the data into *Microsoft Excel* for statistical analysis and graphing (Andreasen, 2003). This method is rather time consuming for the staff and expensive for the National Museum. Current computer technology provides a possible solution by automating the survey process, which in turn reduces the time spent on survey creation, data entry, and analysis. The museum desired two separate methods of electronic surveying: staff members interviewing patrons while entering data into the computer, as well as the patrons

themselves taking the survey and entering responses directly. Both of these options may be achieved utilizing software packages specifically tailored for surveying, using suitable hardware configurations.

The ultimate goal of the project team was to provide the National Museum with a comprehensive analysis of their surveying options and to recommend methods to improve the efficiency of their surveying techniques. Included in this report is background research on the surveying techniques of other museums and institutions, research and testing on existing survey software and hardware, results and analysis of field tests, and recommendations for the National Museum.

Several steps were taken to insure that an informed decision was reached. Following this introduction is a flowchart outlining the major components of the project. The upper half of the flow chart represents what was accomplished while in Worcester. The first step was to conduct background research on survey methods, other institutions, existing survey software, and the National Museum. Using information gathered from research of other institutions and software companies, interviews were conducted with marketing and visitors department of other institutions as well as sales representatives of software companies. With the knowledge gathered from background research and interviews, assessment and comparisons were made of other institutions and of survey software. This results in a report of visitor survey methods at other institutions and a preliminary software evaluation.

The lower half of the flow chart represents the steps that were completed in Denmark. Preliminary analysis of available survey software determined which software packages are most likely best for the museum. Surveying the staff as well as the patrons of the museum provided valuable information in further narrowing the choice of software. These methods allowed us to make a sound recommendation to the National Museum as to their improvement of patron feedback collection.

Providing the National Museum with the best option of collecting museumgoers' feedback will provide many benefits in the long run. Even though the initial cost of implementing an electronic survey system may be expensive, future expenses will be reduced by limiting staff time spent on data entry and analysis.

The analysis provided by a new system will aid the museum in better understanding the thoughts and needs of the patrons. By using a computerized system for patron feedback, results are quickly available for analysis. Using software specifically designed for surveys facilitates the analysis and interpretation of survey data. Improved survey analysis in turn will help the museum to identify areas in need of improvement. Through our recommended survey system, the National Museum will better obtain and process crucial customer feedback which will aid them in decision making.

Project Flow Chart

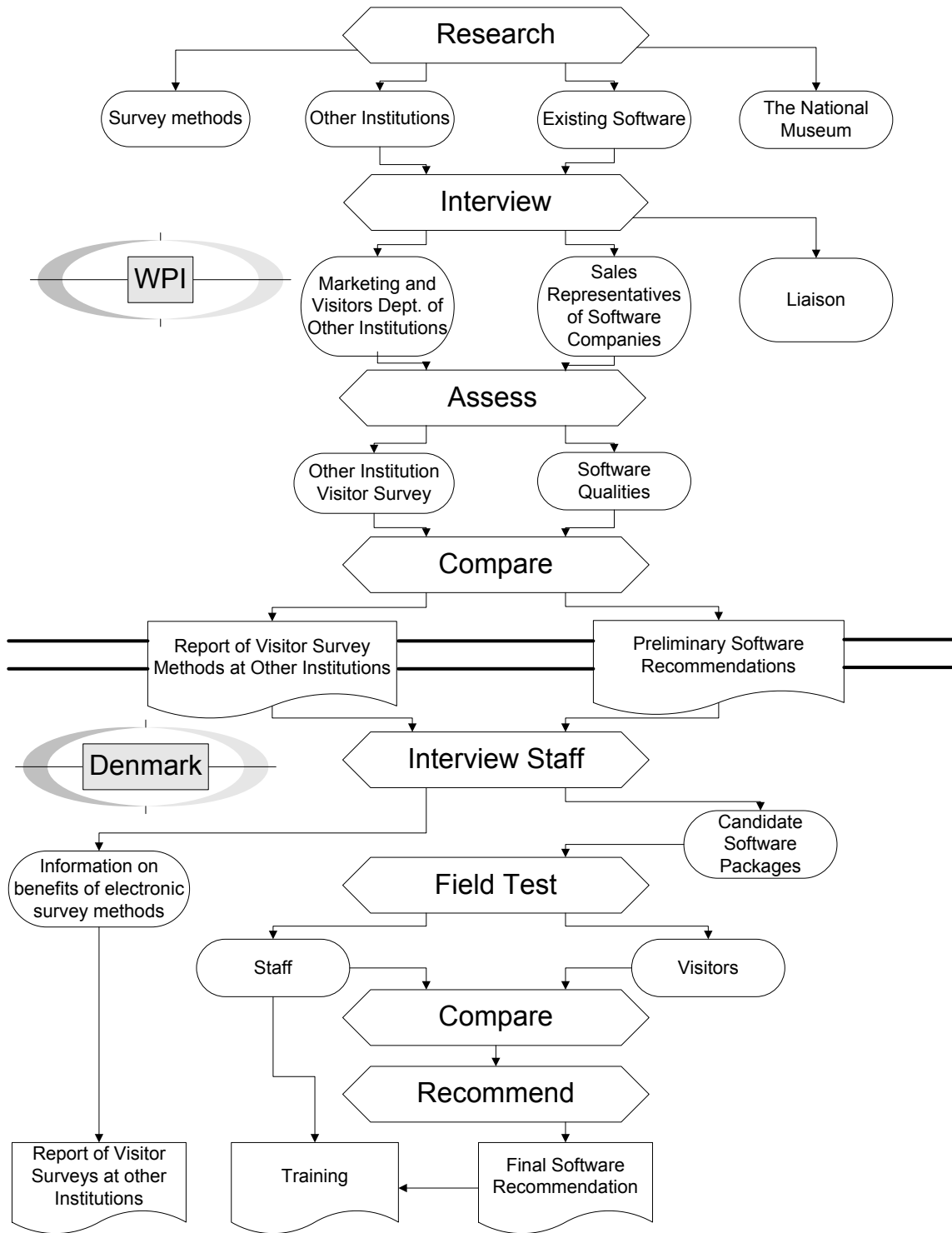


Figure 1: Project Flow Chart

Background

In preparation for this project, the project team needed to conduct research in various areas of information. First, the objective, history, and structure of the National Museum were researched in order to establish a knowledge base of our sponsor organization. The next section researched was surveying. Here the team researched surveying method selection and techniques, implementation, limitations, motivation, the use of computers, and surveying done at other institutions to gain knowledge on how to appropriately conduct a survey. The third section is in reference to what and how statistical analysis techniques can be used to process the collected data. The last section explores currently available software packages that could be used to conduct a computer survey.

The National Museum

Objective of the Museum

The main objective of the National Museum is to strengthen the visitor's knowledge and understanding of Danish culture, the landscape, the diversity of different cultures, and the Danish cultural identity. The museum's major subjects are archeology, ethnology, numismatics, ethnography, natural science, conservation, communication, building antiquarian activities in connection with the churches of Denmark, and the handling of the Danefæ, the National Treasures.

History of the National Museum

The National Museum has a rich history in its development. It has grown from a few delicate exhibits into one of the greatest museums in Scandinavia. Through its development, the museum has provided answers to questions that no one has even thought of before. Telling the history of the museum itself is ironic in that one of the main goals of the museum is to educate about the history of Danish culture and of other cultures alike.

The roots of The National Museum of Denmark lie in the Royal Cabinet of Curiosities' collections of rare arts and crafts, paintings, artifacts, weapons, and antiquities. King Frederik III founded these collections around the year of 1650. These exhibits, which were originally housed in different locations, brought forth the birth of the National Museum. In 1807, the Royal Commission for the Preservation of Antiquities was established to preserve monuments and to protect and display antiquities. Christian Jürgensen Thomsen, the secretary of the Commission, was the driving force behind making the primitive museum into what it is today. In 1832, the antiquities were relocated to a more accommodating site at Christiansborg Palace. New legislation was passed in Denmark stating that there was to be a separation between royal and state properties. The government decided that the state collections should be housed at the Prince's Palace. By the end of the 1850s, all the collections had been moved to the Palace at Frederiksholms Kanal, which is the current location of the main museum. The name "The National Museum of Denmark" was given to the entire complex in 1892 (Hvass, 2001).

Structure of the Museum

As we are to develop a system survey that can link the different facets of the museum, we need to learn of the physical structure of the complex. The museum, since its inception, has expanded to locations all over Copenhagen and its surrounding areas.

The palace where the collections were displayed constantly required additional expansion as more exhibits were displayed. The problem was temporarily solved by the acquisition of an industrial complex at Brede near the Mølleå in Kongens Lyngby north of Copenhagen in the 1950s. Further expansion took place in the Mølleå area, which included a large storage facility and exhibition hall. As popularity increased, the palace underwent further expansion, the latest being completed in 2001. Along with the Prince's Palace, there are many other locations in and around Copenhagen that are part of the National Museum, including the National Museums' Victorian Home, the Little Mill at Christianshavn, the Museum of the Danish Resistance 1940-45, the Open Air Museum, and the Industrial Works at Brede (Hvass, 2001).

The National Museum of Denmark and its multiple complexes contribute greatly to the preservation and education of Danish culture and society. Visitor feedback helps the museum accomplish these goals. Proper and effective surveying techniques are necessary to aid in “provide[ing] a basis for societal and individual understanding of Danish culture.” (Hvass, 2001)

Surveying

Surveys are an important means of obtaining information from a targeted group of people. Conducting a survey from start to finish requires a meticulous process to insure that the most accurate and useful data are obtained. This involves selecting an appropriate method of surveying, designing the survey to minimize bias and error, and understanding the limitations of surveying techniques.

Selecting a Method

Choosing the right survey method is the key to conducting a successful survey. Most methods are only effective in certain situations. Implementing the wrong method can result in a higher probability of introducing error or bias, as every survey method is susceptible to error and bias in different ways (Leung, 2001).

There are certain key factors to consider when choosing a method. One example is the kind of information desired. There are three types of surveys: needs assessment survey, marketing survey, and evaluation survey. A needs assessment survey is used to gather public opinion about problems and possible solutions. A marketing survey is used to assess a current or future product or service, so as to optimize its demand. An evaluation survey is used to determine the impact of certain programs or policies (Salant & Dillman, 1994).

The availability of certain resources such as money, labor, and time are also important in selecting a method. If overly expensive, a large scale survey won't be possible. Surveys are often time consuming and require people to administer and analyze the results. One should consider who is available to commit to these tasks and whether there is an adequate labor force backing up the survey. The ability to carry out the survey has to be physically as well as financially possible (Doyle, 2001).

The complexity of the questions asked in the survey also plays a role in the method choice. This involves how the questions need to be conveyed, whether through written words, pictures, sounds, or dialogue. For some surveys an expressed opinion is desirable. In that case, a focus group might be a better choice than a paper or electronic survey. Electronic and paper surveys, however, are better for multiple choice type questions where the answers are easily conveyed with the choices on the survey (Doyle, 2001).

Characteristics of the respondent, such as their location, knowledge, and availability can affect the choice of an optimal surveying method. In conducting a method, the location of the target survey group must be considered in order to choose the most appropriate way of gathering information. The target group needs to be able to take the survey whether it is over the phone or in person. The knowledge of the respondent should be considered as well, in that they need to understand what is being asked of them clearly and easily. Availability and convenience of the survey are also important. Whether the respondent is able to talk to the surveyor or has other constraints change what type of method is best to be used. The target group needs to be well defined and considered in each method (Doyle, 2001).

In the selection of a method, the scope and desirable end results need to be addressed. The surveyor needs to figure out what type of data he/she wants from the survey. Qualitative data might be more difficult to accomplish in some methods, while quantitative data might be boring for the subject in other methods. Understanding the type of information gathered in the survey leads to the type of analysis needed. Knowing the appropriate analysis needed, the surveyor can plan for the means to conduct such analysis. Looking at the entire scope of the survey from beginning to end beforehand helps in conducting a successful survey (Leung, 2001).

In choosing a method to conduct a survey, the scope of the survey should be well defined and understood. The background research and deliverables should be decided before a method is chosen. Many factors go into choosing a method, not just the ones mentioned here. Thus, it is important to take the time to look over every aspect of the proposed survey, and pick the most suitable method.

Types of Survey Methods

There are five basic methods of surveying: mail surveys, telephone interviews, face-to-face interviews, drop-off surveys, and computerized surveys. Mail surveys involve mailing out paper questionnaires to a target group of people with the desire that they promptly fill them out and send them back. Telephone interviews require all the target group to have a phone so that the interviewer may call to ask survey questions and complete data collection procedures. An interviewer who asks the respondent questions conducts face-to-face interviews. The interviewer on a questionnaire notes the answers. Drop-off surveys are a combination of face-to-face interviews with mail surveys. The surveyor goes door-to-door to personally deliver surveys that the respondent can complete at his or her leisure and send back to the surveyor or wait for pick up. Computerized surveys are designed to take the place of face-to-face interviews in order to lessen human interaction biases and speed up collection of results and analysis (Salant & Dillman, 1994).

Interviewing Techniques

One important way to obtain feedback from a desired population is to conduct face-to-face interviews. This allows the interviewer to acquire wanted information from a person, along with any other valuable information they may provide. The main benefit of interviewing is that more information can be extracted than through questionnaires. Although the basis for most interviews is a specific questionnaire, the interviewer has the ability to probe the respondent to obtain the needed information.

There are several general guidelines for conducting an interview. First, there is a brief introduction where the interviewer kindly greets the respondent, introduces him/herself, and states that he/she would like to ask them some questions. In this introduction, it is vital to develop a good rapport with the respondent so as to make them feel comfortable. Next, the interviewer is to offer a brief explanation of the survey. The purpose of this explanation is to convey to the respondent why they are conducting the survey, approximately how long it will take, and to remind them that participation is completely voluntary and anonymous. The next step is to begin with the first question.

The interviewer does not want to waste too much time in the introduction as to keep the session as brief as possible.

The interviewer must ask each question exactly as it appears on the prepared questionnaire in the exact order for every interview. If the questions are asked differently, even in a trivial or casual way, the interviewer will introduce bias. A pre-coded question is where there are several distinct answers. For questions with pre-coded answers, the pre-codes should never be read aloud or used as prompts. The interviewer should allow the respondent to give their answer, and it is the responsibility of the interviewer to classify it into one of the pre-coded answers. If the given answer is very different than any of the pre-coded answers, the interviewer should try to steer the conversation in a direction where the user more fully understands the scope of the question. An open-ended question is where there is a space after the question where the interviewer writes down the respondent's answer in its entirety. The response should be written down word for word to eliminate any bias that can be introduced if the interviewer paraphrased his/her own understanding of the answer. If a response is unclear, the interviewer should ask neutral questions to encourage the respondent to clarify or expand on their response.

After all questions have been asked, the interviewer shall quickly glance through the questionnaire to ensure that all necessary information has been completed. The interviewer shall then thank the respondent and leave them feeling that they have made a valuable contribution to the survey (Smithsonian Institute, 2003).

Kiosk Surveying Techniques

Another important way to obtain feedback from a desired population is to implement a kiosk survey. This is where a computer is set up for respondents to approach on their own to complete a survey. The main benefit of kiosk surveying is that it does not require time of personnel to distribute the questionnaire or interview respondents.

The physical structure for the kiosk plays a substantial role in the success of the survey. It needs to be in a location where the target population will pass by and notice it. There are several methods to entice people to take a survey. One is to make the

survey an attraction. Another is to build the computer terminal into something that grabs the attention of the patrons. For example, if there is a new, exciting exhibit, encapsulating the terminal into the exhibit can make patrons feel like they are experiencing part of the showcase. This will also make the system more visually striking and therefore attract more people to it. Another way to draw people into taking the survey is to offer them some kind of reward such as discounted tickets or prizes.

The survey itself needs to be completely self-contained. The directions for the survey need to be clearly defined either on the kiosk structure or on the computer screen itself. The user should also be able to access a help screen if they require further assistance. Because there is not a staff member immediately at the kiosk, each question needs to be very clear and precise so as to not to confuse the respondent. Navigation through the survey also needs to be very clear so the user can easily flow through the progression of the survey. When the survey is complete, the user should be presented with a thank you screen to ensure that they leave feeling they made a contribution to the survey.

Paper Surveying Techniques

A third way to obtain feedback from a desired population is to conduct a paper survey, either distributed through the mail or in person. With a paper survey, the respondents fill in their answers on the questionnaire. Once all completed surveys are collected, the data must be coded and entered into a computer program, such as *Microsoft Access* or *Excel*. The main benefit of paper surveying is that many questionnaires can be completed simultaneously.

The physical design of the questionnaire is a very important aspect of this method of surveying. The respondent's reaction to the appearance of the survey can dictate the way they answer the questions, or even participate at all. If the questionnaire is carefully constructed in a very professional manner, respondents will be more likely to be honest and take the same care in answering the questions. On the other hand, if the questionnaire is poorly designed and has careless errors, respondents may be equally careless when answering the questions, if at all.

There are several guidelines that should be followed in designing a questionnaire. First, the questionnaire should be organized. Related questions should be grouped together, flowing from most important to least important. Secondly, the survey should not contain only questions. It is important for the questionnaire to include introductions, directions, and transitional statements to help guide the respondent. Third, great care needs to be taken when decided on the first few questions. This is important because those questions are what will attract and motivate the respondent to complete the questionnaire. Lastly, the formatting of the questionnaire needs to be carefully considered. Important issues here are consistent fonts, font size, and spacing, along with high quality paper and printing. Standardization is very important in the formatting of the questionnaire as it reduces time and effort of the respondent to complete the survey. (Salant & Dillman, 1994)

Designing and Implementing a Survey

Once the appropriate method is selected, the design and implementation of a survey can be generalized into six steps. First, the scope of the project plan should be well defined before going further with the process. Second, a survey instrument must be created. Questions need to be meticulously formed while keeping in mind the limitations of the chosen survey method and the biases that may occur with the use of certain questions. Third, the survey needs to be distributed according to the survey method chosen. Fourth, the answers to the questions need to be tabulated once the surveys are returned. Fifth, the data received need to be analyzed. Finally, the results of the data analysis needs to be reported, and conclusions drawn (Phillips, 1996).

Survey Limitations

In designing a survey, one must consider that there are limitations to conducting surveys. Although surveys can establish relationships between variables, they aren't conclusive enough to say that there is a direct relationship. The whole survey process and motivation behind the survey must be taken into account. If the survey results are taken out of context, false interpretations of the results may occur (Doyle, 2001).

Much of the unreliability of surveys comes from the individuals being surveyed. Their attitudes and characteristics may affect their honesty and accuracy. Most inaccuracies, however, are due to the individuals committing “honest” mistakes. They could be confused, misinformed, recalling a false memory, or being led by the surveyor’s questions. This can also come into play if the surveyor hasn’t created an appropriate survey. Individuals also have a tendency to be swayed in their answers to surveys merely by the fact that they know they are being surveyed. This is often because individuals being surveyed give answers they suspect the surveyor wants as results (Doyle, 2001).

Surveys can show general opinion and demographics, but they shouldn’t be solely relied upon. Other methods, such as focus groups and interviewing, should be considered to test for survey bias and error, and to collect different kinds of information. Conventional methods of surveying can be very time consuming and labor intensive. Conducting a pretest survey on a small group before conducting a larger, more costly and important one can help discover and fix some of these problems (Doyle, 2001).

Motivation for Survey Taking

In any survey it is important to achieve a high response rate to get the most accurate data to make informed generalizations. The response rate is the proportion of respondents to take a survey out of the total possible number of people given a survey. The design of the survey can affect the response rate significantly. An attractive design and layout can be very pleasing to the person being surveyed. People will be more likely to take a survey if it is fun and informative at the same time. The person shouldn’t come away feeling like they just wasted their time taking a survey. The survey should be organized, easy to follow, and complete without error (Doyle, 2001).

If the survey is appealing to the targeted audience, then the response rate will be high. It is always desirable to have fun and get some sort of reward when taking a survey. One wants to have more than just questions in a survey such as factual information that is important to the person being surveyed. These are elements that are important to think about when designing a survey.

Surveying with Computers

There have been many studies done in exploring the effect computers have on surveying and interviewing. These studies aim to determine if there is a difference in responses to a computer versus pencil and paper questionnaires. Even with the increase in importance of such research, there is a lack of consistency with such studies. Some conclude that there is a difference in answers to different modes of administration (Lautenschlager & Flaherty, 1990; Lee, Moreno, & Sympson, 1986), while others found that there is no significant evidence to suggest a difference (Booth-Kewley et al., 1992; King & Miles, 1995).

This discrepancy in results seems to follow a notable trend. Older studies tend to find a difference in responses with computer questionnaires versus responses with pencil and paper questionnaires. In recent years people have become more familiar with computers. A study by Lee, Moreno, and Sympson in 1986 found that people taking a computer survey who had more computer experience felt less anxious than those with little computer experience. Although Lee et al. (1986) came to the general conclusion that taking a survey on a computer changes the respondent's answers; they were actually looking at the results from people with little past computer experience. The people with greater experience had few differences in results from those taking the pencil and paper surveys. With the recent increase in computer use, the results from this study may be somewhat outdated and need to be considered in their timeframe. Although the percentage of people comfortable with computers today is larger than at the time of the study, there are still people, such as elderly or disabled, who may feel uncomfortable using a computer. This must be considered when determining the sampling frame for field testing.

In more recent studies it has been concluded that there are more advantages than disadvantages to the computer administration of surveys. Such advantages are ease of administration, elimination of missing responses, elimination of data entry, automatic scoring, and question-branching capabilities. It has been found that although respondents enjoy completing a computerized questionnaire more than a paper and pencil version, the means for the decision-making scale were not significantly different (Booth-Kewley et

al., 1992). Such evidence can justify the use of a computer over pencil and paper for administering a survey.

Another thing to consider regarding these studies is the style of questions in each survey. All these studies were self-assessment studies. When looking at the results from these surveys, it shall be noted that the respondents of the museum's surveys will be evaluating the National Museum, not their own behavior. Another area of interest is testing how people assess others (Nass, Moon, & Carney, 1999). Nass, Moon, and Carney (1999) examined the idea that people might consider the computer as a human when asked to assess the performance of a computer. In this study a computer performed some task and the observer was then asked to take a survey on how the computer performed. There were three ways this was completed. The first way was the observer took the survey on the same computer that completed the task. The second was a survey done by pencil and paper right next to the computer. The third was the observer was taken to another room to complete the same survey on a different computer. All the survey questions were the same. It was found that the observers assessed the computer's performance significantly more favorably when the same computer gave the survey than the other two modes. It must be taken into consideration that a person may be less critical when asked to evaluate the computer's performance on the same computer. The researchers also observed no significant difference in the assessment of the computer between the other two modes. One might conclude from this study that there may be human biases still remaining in computerized administration of surveys as there are in pencil and paper surveys (Nass, Moon, & Carney, 1999).

Human interaction with computers is significantly changing from year to year with the increase in technology. Many more researchers are choosing to perform computer surveys. Thus, it is important to understand human reaction to such surveys and how they compare to ones taken in the past via pencil and paper.

Surveying at Other Institutions

In implementing a new survey system at the National Museum it is important to see what similar institutions are doing in the area of visitor surveys. This includes which methods are used to obtain visitor information as well as the reasons for

such methods. Particular attention shall be paid as to which software is used and for which parts of the survey process: creation, administration, and analysis.

The institutions that were contacted because their surveying methods were of interest are listed in Table 1. These institutions were chosen in three ways. First, institutions close to Worcester were selected so that their surveying practices could be seen on site. The second group contacted was large institutions throughout the U.S. because larger institutions may have more advanced surveying techniques. The third group contacted was institutions that are known survey software users that could possibly provide some information on computer surveying. Most institutions still use a paper and pencil method for visitor surveys, while very few currently use a computerized system. Those institutions that do not utilize a computerized survey system are mentioned in Appendix 1. Focus will be placed on those institutions currently using survey software.

Geographical	Large Institutions	Known Software users
Worcester Art Museum Andover Historical Society Concord Museum Battleship Cove Boston Museum of Science The Springfield Museums Ecotarium Boston Museum of Fine Arts	Museum of Modern Art New England Aquarium San Diego Zoo Computer Museum of America Museum of Flight Philadelphia Museum of Art Audubon Institute American Museum of Natural History California Academy The Dr. Pepper Museum	Smithsonian The Cleveland Museum of Art The Chicago Museum of Science and Industry

Table 1: Institutions contacted

The Chicago Museum of Science and Industry is located in Chicago, Illinois. The museum is noted as being a pioneer in the use of interactive displays. It is the Western Hemisphere’s largest science museum located in a single building (The Chicago Museum of Science and Industry, 2003). This museum conducts electronic visitor surveys. These are housed in eight different survey devices throughout the museum in

places where guests have some free time, i.e. toilet areas, food areas, etc. The surveys are done in both English and Spanish and feature about 75 questions about museum amenities, customer service, exhibits and communication efforts. This has been their method of surveying since September of 2000. Each week the survey data are downloaded and every month the survey is updated with exhibit and Omnimax theater schedule changes. The software used is from a company called Eventcorp Services Inc. out of British Columbia, Canada. Survey information is used primarily for marketing and public relations (Novinger, 2003).

Philadelphia Museum of Art is located in Philadelphia, Pennsylvania. Founded in 1876, the museum is unique among American museums in its integrated presentation of a full range of fine and applied arts from Asia, Europe, and the United States spanning over 2,000 years (Philadelphia Museum of Art, 2003). The museum currently administers paper and mail surveys which are analyzed using the statistical software SPSS. When data entry is performed in-house they use *Microsoft Excel*. The museum is currently seeking to upgrade to an electronic survey system. They have looked into *Snap*, *Survey Pro*, *AccessPoint* by Global Bay, and SPSS products. All except *SurveyPro* have PDA¹ capability, which the museum is interested in, but they think it will be something they work toward rather than start off with in their upgrading. SPSS is probably the most powerful software with regards to analysis, and the family of products allows the museum use a variety of data collection methods (paper, PDA, web, etc). *AccessPoint* is unique in that the customer subscribes to it, creates questionnaires on-line, and then downloads it to a PDA. The data are then uploaded from the PDA to the website to perform analysis. According to Gina DiGiacomo of the Philadelphia Museum of Art, *SurveyPro* was found to be inflexible with respect to questionnaire design, but many museums without an in-house researcher use it because the analysis is simple and straightforward. In other words, it is not for the person who wants to look at subsets, code data, or run more complex analyses (DiGiacomo, 2003).

The Smithsonian Institute is located in Washington D.C. and encompasses many sites around the area. They are the world's largest museum complex and research organization. The Smithsonian is composed of sixteen museums and galleries including

¹ Personal Digital Assistant

the National Zoo (Smithsonian Institute, 2003). There they used a document scanner called TeleForm by Cardiff to scan paper surveys, and use SPSS or SAS to analyze the data. The Teleform costs US \$6,000 (approx. 42.000 kr.) (DiGiacomo, 2003). There is a published “Interviewer’s Manual” on the web provided by the Smithsonian Institute for their staff training (Smithsonian Institute, 2003). The Smithsonian has been in contact with the National Museum and is willing to discuss surveying issues in a phone interview; however no further contact has been successful since contact with them in the United States (Doering, 2003).

Statistical Analysis

Statistical analysis incorporates a set of methods to compile, analyze, present, and interpret data. Statistical analysis methods are used in a wide variety of occupations and help people identify, study, and solve many complex problems. The results of such analyses contribute to the decision making necessary in many occupations.

Statistical analysis involves dividing the methods for analyzing data into two categories: exploratory methods and confirmatory methods. Exploratory methods involve discovering trends in the data by using simple arithmetic (mean, median, mode, standard deviation, etc.) and simple graphs (bar graphs, scatter plots, pie charts, etc.) to summarize data. Confirmatory methods involve forming hypotheses before data collection that attempt to answer specific questions (Arsham, 2003).

Visitor survey data requires statistical analysis in order to focus on the interpretation of the output to make inferences and predictions. Some statistical methods include descriptive statistics as well as correlation assessments. Descriptive statistics are simple statistics that can be used to further understand the characteristics of the data collected. Correlation tests include ANOVA (Analysis of Variance), t-Tests, and chi-square test for association.

It is important to understand descriptive statistics that numerically describe the data by presenting characteristics of the data. In most cases, the principal descriptive quantity from a set of data is the mean. The mean is an arithmetic average of the data. This single value accurately represents the data set if the data is normally distributed which means that there are an equal amount of data larger than and smaller than the mean

value. If this is the case then the mean is equal to the median which is the value where half the data set falls above and half below. The median represents the data set more accurately when the data set is skewed meaning that there are a few values that are so large or so small that they have an exaggerated effect on the value of the mean. These numerical statistics are important but not all data sets allow these calculations because they are categorical. In this case the mode, which is the most frequent observation of the data set, is most representative of the data set (Arsham, 2003).

There is often concern when drawing conclusions as to which value to use: mean, median, or mode. To help in this decision, Figure 2 (Arsham, 2003) is a graphical representation of how to choose the appropriate statistic when drawing conclusions.

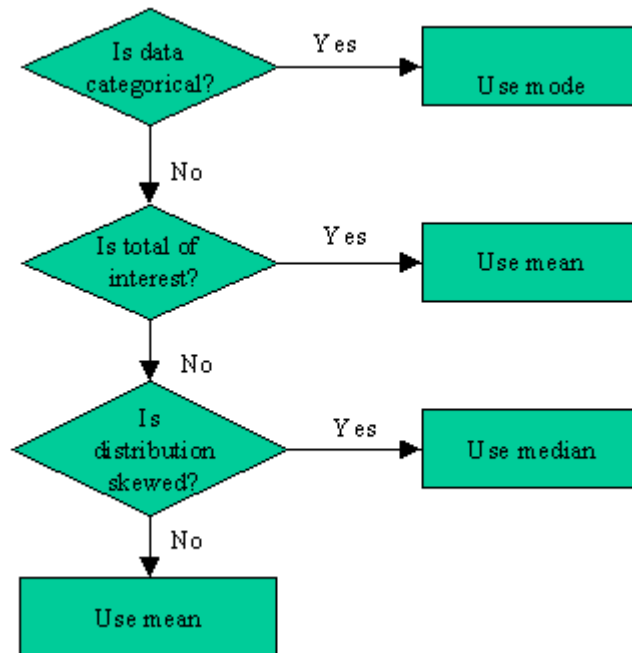


Figure 2: Decision for choosing mode, mean, or median (Arsham, 2003)

Deviations about the mean of a data set are a basis for more advanced statistical tests. This variability about the mean is expressed as variance or standard deviation. Standard deviation is a number that indicates how much, on average, each of the values in the distribution deviates from the mean of the distribution. Variance, however, is the average squared deviations about the mean. The variance is the square of the standard deviation. For large data sets of (more than 30), approximately 68% of the

data are contained within one standard deviation of the mean, 95% fall within two standard deviations, 97.7% fall within three standard deviations (Arsham, 2003).

Correlation assessments are important in establishing relationships between sets of data. The t-Test, a simple test comparing the means of two sets of data, provides data regarding the significance of the difference in means. As with any statistical test there are assumptions that must be met in order to assess whether or not the correct test has been performed. The first assumption is that the data are normally distributed. A second assumption is that the data set sizes and variances are approximately equal. Without these assumptions the test could be unreliable or misleading. The data sets can be independent or dependent but must be noted as one or the other since the tests differ. An example of when to use this test is to compare the means of test score between men and women. With this test it is acceptable to have a small sample size (less than 30). For a larger sample size the z-Test is more appropriate. They are the same tests just for different sample sizes (Garson, 2003).

In cases where there are more than two categories of data to be analyzed, a more complex test must be performed. In these cases ANOVA (Analysis of Variance) is an appropriate measure of statistical significance. This method can assess the significant difference in the means of two or more categorical variables with regard to a dependent (typically continuous) variable. An assumption made with this test is that the data are normally distributed. This correlation test is classified as a basic one-way test. There is also a two-way test with ANOVA in which there are two or more categorical variables assessed with respect to two sets of data for the dependent (typically continuous) variable. With some statistical analyzers an n-way ANOVA test is an option. In this test there are two or more categorical variables assessed with respect to n-number of sets of data for the dependent variables (Garson, 2003).

Along with the tests for significant difference in means, there is a chi-square test for association that proves useful when drawing conclusions from collected data. Using the chi-square distribution, two variables can be tested for significant dependence, whether or not there is a relationship between the two sets of categories. This test is done in tabular form to assess whether or not there is a relationship between the table's rows and columns. The hypothesis tested is that there is no significant

difference between the categories. An example of when to use this test is in determining the relationship between cigarette smokers and drug users. After surveying a group of people a two-by-two table could be made with these possible answers: (no, no) (no, yes) (yes, no) (yes, yes). By compiling the number of people in each category, a test can be made as to whether or not drug usage is independent of cigarette smoking by using the chi-square distribution. A condition for using this test is that there must be a related expected value greater than five responses in 80% or more of the cells in the table. Using chi-square in a two-by-two table requires the Yates's correction. Most statistical analyzers have this correction built in. The result of a chi-square test gives a chi-square value that in turn can be associated with a p-value (Arsham, 2003).

With many tests, a p-value is obtained through most statistical analyzers. The p-value is a number that shows the statistical significance of the test as illustrated in Table 2 (Arsham, 2003). The p-value gives the probability that the null hypothesis, which states that there is no significant difference or association between the categories being tested, is true. So in order to show an association or significant difference between categories, the p-value needs to be small according to the table below, which is generally used as the values of significance.

P-value	Interpretation
$P < 0.01$	Very strong evidence for significance
$0.01 < P < 0.05$	Moderate evidence for significance
$0.05 < P < 0.10$	Suggestive evidence against significance
$0.10 < P$	Little or no real evidences against significance

Table 2: P-value Interpretations

Although these p-values can be used to find significance, they themselves cannot be compared against each other in multiple assessments for statistical conclusions (Arsham, 2003).

These statistical tests and descriptive characteristics are only a few of the many statistical tests. Because these are the most commonly used in the analysis of

survey data, they were selected to aid the National Museum in their future analyses of their visitor survey data.

Survey Software

The spread of computer technology, especially of the PC, has introduced the computer into many aspects of industry. This, in turn, requires various types of software to properly use the computer in its intended roles. In the case of surveying techniques, computers can facilitate the creation, deployment, and analysis of surveys through the use of specialized software. Numerous software companies have developed comprehensive survey software that may be modified to fit the needs of the end user. Such software packages vary in style, content, cost, and several other aspects. Understanding the features, strengths, and weaknesses of each software package is crucial in deciding which would best fit the needs of the National Museum.

The majority of survey software packages available consist of three major elements: the survey creator, respondent program, and data analyzer. The survey creator is the piece of the software used to create questions and define the interface with which respondents will interact. The respondent program is the interface in which respondents enter their answers to the survey. This element is responsible for storing respondent data in a database. The statistical analyzer is used to compile respondent data and produce meaningful representations of comparisons and trends. These three elements combined comprise the majority of survey software packages available.

Survey Software Features

The first step in the analysis of existing software is to gather preliminary background information about each package from company web sites, product manuals, and software reviews. Through these sources, information may be obtained as to the platforms used for survey distribution, cost, system requirements, data storage format, and a list of customers who use the package. The following sections describe these software attributes and six leading survey software packages.

The first aspect that may be determined from software documentation is whether it is web based or PC based software. This is determined based on whether the

software is tailored towards web surveys or standalone PC surveys. If survey creation is automatically tailored towards web surveys, the survey will take on the appearance of an HTML² document or web page. HTML is more limited than PC software in multimedia content such as video, sound, and high-resolution pictures. This is due to the fact that web surveys must take into account the amount of time required to download the survey over the Internet. Web surveys must also be run on top of a browser such as *Microsoft Internet Explorer*, precluding full-screen display. If survey creation is aimed more towards a generic PC-based application, there are fewer restrictions on multimedia, but the possibility for translating the survey to the web is limited. The program would not rely on an Internet browser and could thus make full use of a PC's large hard drive, full screen display, and more system resources. There are also those survey creators that take both situations into account and utilize dynamic survey creation. This is essentially the act of creating surveys that can be easily ported between web-based programs and PC programs.

The next element that can be determined by software documentation is the platforms it can be distributed on. Web browsers constitute one platform for survey programs. Those surveys that are web-based may use web browsers such as *Microsoft Internet Explorer* and *Netscape Browser* to run the surveys. Web-based surveys are the primary options when a survey is to be distributed to a large group over the Internet. Responses are automatically downloaded to a central server location. Along similar lines are surveys distributed through e-mail. E-mail surveys entail the respondent downloading the survey and e-mailing responses to the surveyors. The final platform for surveys is a PC program, which is run as a standalone product. Such a program would run on a Windows platform and is ideal in a kiosk setting. This is because it is not necessary to administer the survey over the Internet, but rather it stays in one physical location. Results are stored either on the machine's hard drive or on a networked central location. A subset of PC programs is Java programs which may be run on platforms other than Windows, such as Linux or Mac OS. Java applications differ from Windows applications in look and feel. Some notable differences are the style of buttons and minimize/maximize control.

² Hypertext Markup Language

The final aspect of survey software that can be determined from documentation is cost. Some software offers a variety of modules or plug-ins that the customer can purchase at varying costs. By only purchasing those modules that are needed, price is reduced. Where this is the case, the configuration that is most suited to the National Museum will be chosen, and the price listed accordingly.

Companies, Software, and Features

Among the first companies to develop survey software was the company Survey Said™. Their software package is split into three separate programs: a survey creator, a respondent program (the actual survey to be administered), and a data analyzer. There are two options for actually conducting the survey. The first option is to administer the survey over the web and store the results on a local server. The second option is to administer the survey on a stand-alone PC and store the results on the PC's hard drive. Both options run the survey on a Java platform on top of Windows. The software package costs between US \$700 and \$1,000 (4.800-6.900 DKK). Some notable companies who use *Survey Said* software are 3M, Hewlett Packard, and Intel (Survey Said SE/EE Reference Manual, 2003).

Perseus Development Corporation offers the software package *SurveySolutions XP*. This package is heavily integrated with Windows and can make use of programs such as *Microsoft Word* for text processing and *Microsoft Access* for database creation. While the surveys may be run on a stand-alone PC, they are primarily designed for Internet use. The server application *SQL Server* is used to collect data from web surveys while a statistical analyzer in the package creates colorful, easy to follow results. The package costs between US \$500 and \$1,000 (3.500-6.900 DKK). Some notable companies who use *SurveySolutions XP* are Siemens, John Hancock, and Boeing (Perseus User Manual, 2003).

Apian Software has developed a versatile software package which allows surveys to be administered on a variety of platforms. *SurveyPro 3.0* is the base software package that is used for creating paper surveys and reports. There are then several plug-ins which may be purchased additionally to meet specific buyer needs. *NetCollect* is used for web-based surveys, *DirectCollect* is used for stand-alone surveys, and

KeyCollect is used for large-scale data entry. In particular, the *DirectCollect* plug-in is designed for surveys by phone, e-mail, local area network (LAN), kiosk, and compact disk. The surveys created are very user-friendly and can utilize various forms of multimedia. Survey responses may be stored on a local hard drive or on a network server. The collected data may be later analyzed using the *SurveyPro* software. Respondents and interviewers require only a basic understanding of Windows to operate the software. The cost of the entire package, including the *DirectCollect* plug-in, is between US \$1,800 and \$2,900 (12.400-20.000 DKK). The Smithsonian Institution, the Chicago Museum of Science and Industry, and the Cleveland Museum of Art are among those organizations who use Apian's *SurveyPro* software (Apian Software, 2003).

StatPac Inc. has created a PC-based package for the creation, administration, and analysis of e-mail and Internet surveys. A built-in file transfer protocol (FTP) program allows for easy uploading of Internet surveys as well as downloading of respondent data. The survey creator is used solely for web and e-mail based applications. Thus, the graphics and interface are limited to HTML (must be viewed in a web browser). StatPac's survey software costs around US \$1,000 (6.900 DKK). Some notable companies who use StatPac software are Citibank and General Motors (StatPac Brochure, 2003).

The Survey System is a software package offered by Creative Research Systems with a variety of functions included. *The Survey System* offers a modular approach to purchasing in which several plug-ins are available to fit the purchaser's needs. The first is an Internet module which is used to create web and e-mail surveys. Another module of interest is the voice capture module that allows survey respondents to respond vocally into a microphone. This allows for better analysis of open-ended questions because the tone of voice can be very important. The graphical reports generated by the Survey System may be further edited in other programs such as *Adobe Photoshop*. The cost for the base package, plus the modules needed by the purchaser, is between US \$1,300 and \$2,100 (9.000-14.500 DKK). McDonald's Restaurants, Reader's Digest, and the New York Times are among those companies who use Survey System (Creative Research Systems, 2003).

Kiosk-in-a-Box Level 4, designed by Rocky Mountain Multimedia, is a package quite unlike the aforementioned software. This company specializes in touchscreen kiosk applications such as mall kiosks, tourism kiosks, and survey kiosks. Rocky Mountain Multimedia Inc. works one-on-one with its clients to specialize the package to the desired end. They will also advise the client as to the best touchscreen hardware for their particular application. Survey responses may be stored as a *Microsoft Access* database file and analyzed using a separate data analysis program. *Kiosk-in-a-Box* costs US \$495 (3.500 DKK) (*Kiosk-in-a-Box* Software Documentation, 2003).

Hardware Platforms

Choosing an appropriate hardware platform on which to display a survey is an important aspect of developing a computerized survey system. Essentially, the system must be set up in a public area where multiple respondents may use it several times. It must be sturdy, tamper-resistant, and require little maintenance. A kiosk is the most logical arrangement as it provides security from vandalism while still providing allure to use the system. There are several elements to consider in creating a kiosk survey system.

A kiosk's monitor is usually its most important hardware component because it is the user's main focus and primary interface. One option for a survey kiosk is a touch screen monitor, which provides a simple and intuitive interface and also stands up to wear and tear better than mice, trackballs, or keyboards. There are two types of touchscreen monitors available: Cathode Ray Tube (CRT) monitors and Liquid Crystal Display (LCD) monitors. CRT touchscreen monitors look similar to a standard desktop monitor. They are generally heavy and bulky and feature a curved glass viewing area. LCD monitors, on the other hand, feature a flat-panel display and would give a kiosk a slim profile. The average cost for a CRT touchscreen monitor is US \$500 (3400 DKK) while the average cost for an LCD touchscreen monitor is US \$800 (5500 DDK) (Kiosk Primer, 2003).

The majority of touchscreen monitors use surface acoustic wave technology to detect touch from a finger or stylus. This technology is highly accurate and never requires recalibration. These monitors may also be easily cleaned with a household glass

cleaner when dirt or dust accumulates. A keyboard with a protective covering may be present for respondents to type in open-ended responses (Kiosk Primer, 2003).

If the touchscreen monitor is the visible focal point of a kiosk, then the kiosk's computer running the software is the brain, so to speak. Each kiosk must contain a computer with adequate processing power, hard drive space, and memory to run the desired survey software. Since most survey software is not very demanding on a computer's system resources, a standard PC running Windows 98 or later should suffice.

The final hardware aspect of a survey system worth noting is the actual physical appearance of the kiosk. Creation of an attractive and inviting kiosk is a major component of providing allure and motivation to take the survey, as mentioned in the prior section. The kiosk should be sturdy and secure so as not to allow non-staff members from opening and tampering with internal components. Beyond this, a great deal of creativity can be put into the kiosk's design. Making the kiosk into a piece of art or an exciting figure can dramatically increase allure and, in turn, increase patron feedback rates (Brown, 2003).

Knowing and understanding the availability and limitations of existing survey software and hardware is a critical step in recommending an upgraded surveying system to the National Museum. A recommendation of software and hardware is one of several deliverables that will be provided to the museum at the conclusion of this project. This background information lays an important foundation for the remaining phases of the project such as testing and surveying.

Methodology

Deliverables

In order to present the National Museum with an efficient computerized survey system, a number of deliverables were provided. First, a report on the survey practices at other museums and institutions was developed describing survey methods used by other institutions from which the National Museum can draw lessons. Second, available software packages were analyzed to determine those that best fit the needs of the National Museum. Third, the manual provided with the software was reviewed. The manual appeared to be fully instructional, so it was not feasible for a supplemental manual to be written to assist with the given documentation. With the completion of these deliverables, a more efficient survey system was presented to the National Museum.

Report of Surveying Practices at Other Institutions

Institutions that provide cultural and educational services, such as museums, zoos, and other centers, conduct surveys of their visitors to better understand the reasons for which people visit their institutions. As part of our project's deliverables, a report of what other institutions are doing in the area of visitor surveys is included as well as lessons that may be drawn from their experience.

The review requires interviewing staff from other institutions. Interviewing is the best method for obtaining the information needed to fully describe the visitor survey methods at other institutions. Interviewing allows direct contact with a person who is in charge of the visitor surveys, giving opportunity for question and answer sessions to deepen understanding of the survey system.

Contact with as many institutions as possible was completed in the United States. This provides the National Museum with a sample of institutions and their visitor survey systems. Sampling of institutions was based on geography, size, and known customers of survey software packages. Geography refers to institutions that are close to WPI. They are of importance because their visitor survey system could be seen first hand. Seeing the system first hand provided a better understanding of the entire system

and how it is used. The larger institutions were chosen because they are most likely to have the most up-to-date surveying systems. Also, through research, some institutions were listed by software vendors as customers. Knowing they use software packages that are of interest, their opinions on the software were obtained. Table 1 in the Background Chapter lists those institutions contacted.

First, contact was made through the email addresses provided on the institution's web page. This email informed them of the project and asked for a contact in order to get the information requested. A sample email sent to institutions can be found in A1.

Contact was then made either via follow-up emails or phone. Information was requested as to what survey methods the museums use. Reasons for methods, software information, and physical structure were asked for each method as well as general information on their surveying practices and other methods for obtaining patron feedback. This is information such as how often they survey, what information they seek, what they do with the results, problems encountered, and general suggestions. A sample interviewing plan can be found in Appendix 1. A description of their physical survey system as well as what software, if any, they use is also very important to the project. A sample table of the information gathered is in Appendix 1. This report will benefit the museum by showing how different systems already in use might work in their institution. It also explains why and how each institution chose the system it is currently using.

The review of visitor survey methods will be very informative and valuable to the National Museum. A comparison of what other institutions are doing to survey their visitors and how that might apply to the National Museum will give the National Museum some new ideas as to other methods to try, and how to implement electronic survey systems.

Analysis of Existing Survey Systems and Software

In order to provide the National Museum with the best survey system, available survey systems were first understood and analyzed by the project team. We identified six survey software packages which vary in cost, host platform, usability, and

various other aspects. It was necessary to identify and test each package first-hand, as well as perform field testing with museum staff and patrons. This project has provided research and testing specifically tailored to the National Museum that cannot be provided by sales representatives or survey literature. By testing each software package based on several user criteria, and by pre-testing select software in the museum itself, the National Museum was provided with adequate data to make an informed choice of software.

Software Pre-assessment

Providing a recommendation beyond mere background research requires hands-on evaluation of each program, rather than relying on documentation. The best way to familiarize oneself with the software is to download a fully functional copy of the software to evaluate and test several aspects of it. In doing this, the three major elements of each package: the survey creator, the respondent program, and the statistical analyzer were analyzed. Finally, the types of questions that the museum intends to ask in their surveys were considered. It was then determined if the software package can accommodate such questions. When pre-assessing the software, the roles of the National Museum staff and of the museum's patrons had to be considered carefully. Working demos from six companies were downloaded for informal familiarization.

Software Field Testing

Pre-assessing the available software allowed the team to focus to be placed on those packages that are best suited to the National Museum. Once the list of suitable software packages was narrowed down to two choices, they were tested in the National Museum. The sales representatives of Apian Software provided a fully working copy of *Survey Pro 3.0* and Rocky Mountain Multimedia likewise provided *Kiosk-in-a-Box* for the purposes of field testing. This suited the need for field testing because the programs could be installed and run at the museum during field testing to collect test data. These valuable data were used to inform us as to the effectiveness, efficiency, and many other aspects of the survey system.

Museum Staff Feedback

In choosing between the two preliminary software choices, feedback from the museum staff about each software package was required. The team needed to be sure that both software packages are feasible for use in the museum in order for our field testing to be successful. This is important because if the museum staff is uncomfortable from the start with one software package or they can foresee one being unusable, the choices can be narrowed. Since there was only one staff member that is going to be using the software, meetings introducing her to the software were conducted. In these sessions, the tradeoffs between each software package were discussed as well as the issues of face-to-face surveying versus a kiosk based survey. Also, limitations the museum or the staff might have that may be a problem with one (or both) of the packages were brought to the team's attention. Since there were no pressing issues from the staff on the initial choices of software, it was deemed that both software packages were acceptable for field testing.

In order for the museum staff to actually get familiar with each software package, an evaluation of the three stages of surveying was conducted. They need to know how each software functions and get a sense of its usability and interface in order to build a reference for their opinions. This was accomplished by guiding the staff through the process of creating a survey. They can then take the survey so as to be aware of the point of view of the visitor taking the survey. There is also a set of data stored for testing the analysis. By being familiar with each software package, the museum staff will be able to offer knowledgeable input with regards to testing.

Testing Setup

Another step in choosing between the two software packages was to field test in the museum. Conducting accurate field testing with the survey system requires adequate hardware. Three different methods of surveying were employed: independent kiosk surveying, interviews, and paper surveys. Each method was physically set up differently from the others based on the optimal position for data collection. A floor plan of the first floor of the museum is seen in figure 3. The various field testing locations are noted and described below.

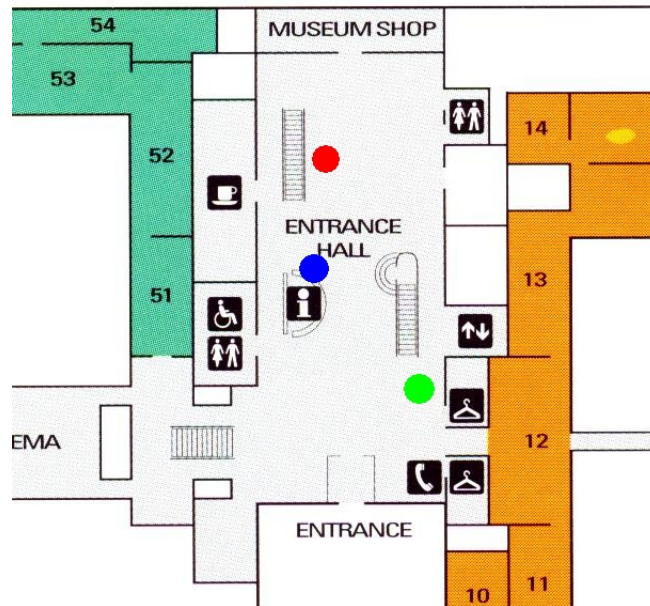


Figure 3: Floor plan of the National Museum denoting testing locations

The first testing setup was located next to the stairs at the north end of the ground floor (● in figure 3). After two days of independent kiosk testing at this location, the project team felt the response rate of roughly eight per day was far too low. The independent kiosk setup was thus moved to the information desk (● in figure 3) where project team members as well as the information desk’s staff members could guide patrons towards the survey. The setup for the interviewing method entailed a table and two chairs stationed near the stairs at the south end of the ground floor (● in figure 3). The staff members conducting the interviews were able to ask people leaving the museum to partake in the survey. Finally, paper surveys with clipboards and pencils were laid out on the information desk in the same location as the independent kiosk setup (● in figure 3). The project team as well as staff members asked patrons to take the survey at their leisure.

The National Museum provided a touchscreen and keyboard to test the software’s touchscreen capabilities. The laptop provided by WPI ran the software being tested, loaded with a survey designed by the National Museum and created by the project team. The survey used in testing had questions pertaining to marketing and demographic information, as well as a few questions at the end to get the visitor’s feedback on taking a computerized survey. Because three survey methods are tested, independent kiosk,

interview, and paper, the last few questions are slightly different in each case. A copy of the questions used is in Appendix 3. One setup was for face-to-face interviews, another was for people to complete the survey on their own, and one for paper surveys. *Kiosk-in-a-box* was the only software package that implemented a touchscreen for the respondent. Respondents using Survey Pro used a mouse due to the smaller and non-resizable buttons.

Conducting Field Tests

Each software package was loaded on the computer on which the surveys were conducted. In each package, a survey was created similar to the paper surveys done in the past in order to simulate an actual survey in the museum. Formulated questions regarding survey satisfaction and computer use conclude the survey. Field testing was done for four days per software program. Two days were spent with a kiosk type setting where visitors take the survey on the computer. The other two days were for an interview setup in which a staff member conducted face-to-face interviews with the visitors.

As mentioned previously, the surveys were conducted in two different methods: face-to-face interviews and independent kiosk testing. For the face-to-face interview method, a staff member stood near the exit of the museum lobby and asked visitors to take a few minutes to complete a survey. The interview consisted of the staff asking the visitor a series of questions from the computer (laptop) and entering the visitor's answers as the interview proceeds. Observations of the interviewee include: time to complete interview, apparent comfort level, approximate age, and any other notable behavior. After conducting these interviews, the interviewer's feedback was obtained as to his/her experience with the software through a follow-up interview. Refer to Appendix 5 for a full list of questions asked to the interviewers.

For the independent kiosk testing, a computer with the same software and survey (with changes to the last few questions) was set up on the information/ticket desk for visitors to take independently. An important aspect of this testing is to view how people react to the kiosk. Observations were conducted from the museum café above the lobby. Observations include: time to complete survey, use of keyboard or touchscreen, whether the survey was completed, and notable observations or behavior. For testing

purposes, a sign was posted near the survey setup asking patrons to take the survey. For the independent kiosk method, respondents were offered a free ticket to the museum if they completed the survey.

In order to have enough data for the field test to be successful, it is necessary to survey many people as they pass by. However, the number of visitors to the museum during field testing was less than anticipated. To ensure enough data were collected, every visitor was asked to take the survey by staff at the museum entrance.

Analyzing Field Test Data

After each field test was completed, the data collected from the sample surveys were analyzed. This provided valuable knowledge on how each package performed. The survey software's own statistical analysis package was used to analyze the results to the museum's questions from the testing phase. By using the software's own statistical analyzer, the capabilities and possible shortcomings of the software's statistical analyzer were discovered. We paid close attention to the questions pertaining to the visitor's reactions to taking a computerized survey. A detailed correlation study is described in the analysis section. These data are very important in that they will inform us as to whether the respondents like or dislike using the computer as well as other important respondent data such as computer experience and survey method preference. Our background research on surveying with computers made us aware of potential bias in computer surveying. This was taken under advisement in our testing process. This information is important to verify the effectiveness of a computerized survey. Once the field test for each software package was completed, the results were compared in order to determine the more suitable software as well as comparisons of kiosk surveys versus interviews.

Final Selection

Once all the statistical data were analyzed from each software package, all the information provided by the field tests was compiled into a report. Upon completion of this report, a meeting with Karin Andreasen was conducted presenting her with the documented information. Information sessions were held to explain and review what was

discovered from the tests allowing Karin to give feedback. Relating the opinions of Karin and us to the objectives of the project helped in choosing the software that will best suit the needs of the National Museum.

Training

The museum personnel will have to be well trained in the use and maintenance of the new system. If used improperly or not to its full potential, the survey system will be less useful to the museum. A training manual was a good way to make sure the personnel of the museum were well acquainted with the surveying system. The manual provided with the software was reviewed and determine to be sufficient so an additional instructional material was not needed.

Knowledge of Software

The first step in developing the training manual was to become knowledgeable about the chosen software package. In order to provide documentation on how to use, maintain, and implement the software, it was necessary to learn everything possible about the software. All of the manuals that came with the software needed to be read in order to learn how to correctly use the program. This also brought to attention all the features the program offered; features that might otherwise be overlooked. This was very important because it allowed the system to be used to its fullest potential. Any further questions regarding the software were directed towards the software company's technical support. Because this was a lengthy process, it was necessary to become well versed in both software packages during the project.

The methods described in this section clearly define the manner in which the final deliverables were derived. A report on the current surveying tactics of other museums may be used by the National Museum to further advance their own surveying methods. In-depth analysis and testing of independent kiosk surveying, interviewing, and paper surveys allowed the project team to recommend a viable efficient survey system. Finally, the provided manual was reviewed to ensure its help in the creation, administering, and analysis of surveys using the selected piece of software. These

deliverables will aid the National Museum in implementing a more efficient visitor survey system.

Results

Using each software package's survey creator, we created surveys containing eleven questions provided by Karin to address visitor feedback pertaining to the museum and three (interview, paper) or four questions (independent) pertaining to the actual survey process. Once testing was complete and all data were collected, the project team compiled the responses and analyzed the results. This next section summarizes the data the team had collected. These results are the responses from 193 museum patrons surveyed using the three methods of interview, independent kiosk, and paper. There were 119 interview responses, 54 independent, and 20 paper.

Raw Data

The first and most important step in surveying is the actual collection of data from the target population. The data collected from surveying must first be pooled and tabulated before any formal analysis can be performed. The field tests conducted in the National Museum yielded respondent data from the three forms of surveying implemented: interviewing, independent computer use, and paper surveys. The raw results from these tests were compiled and later analyzed.

The basic statistical results of the first ten questions in the survey, which are of interest to the museum alone, are provided in Appendix 4. The results of the last four (independent) or three (interview, paper) questions in the survey were used by the project team to assess patrons' survey preference and computer experience. These data are presented in this section with respect to the method of surveying used.

All Methods

Have you ever taken a computer survey before?

41% had taken a computer survey before, 59% had not.

How do you prefer to be surveyed?

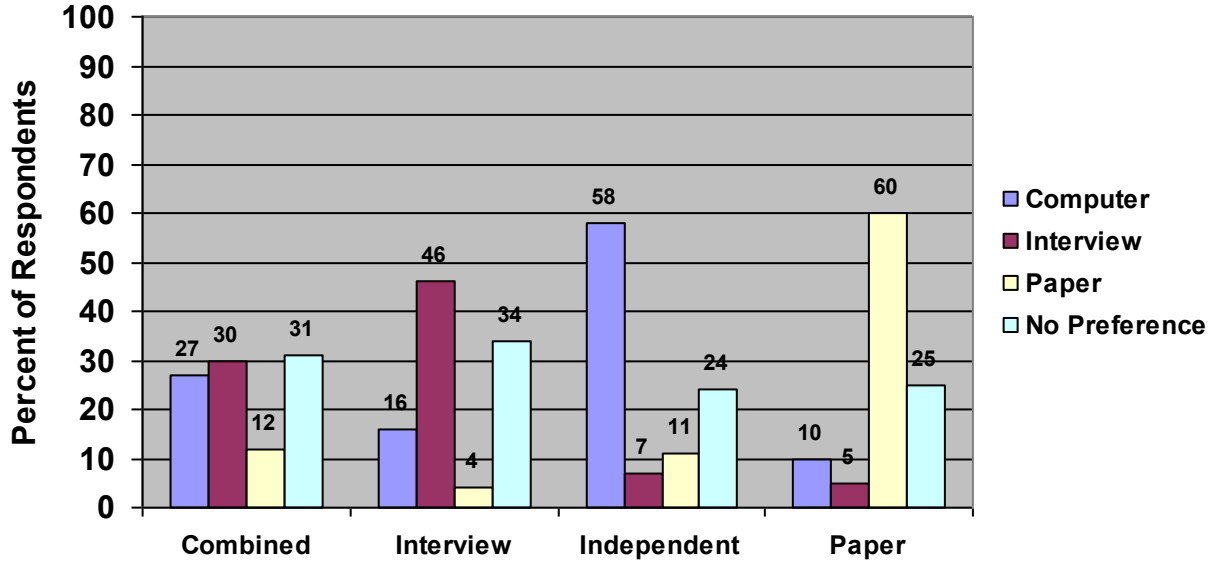


Figure 4: Results of survey method preferred

How often do you use a computer?

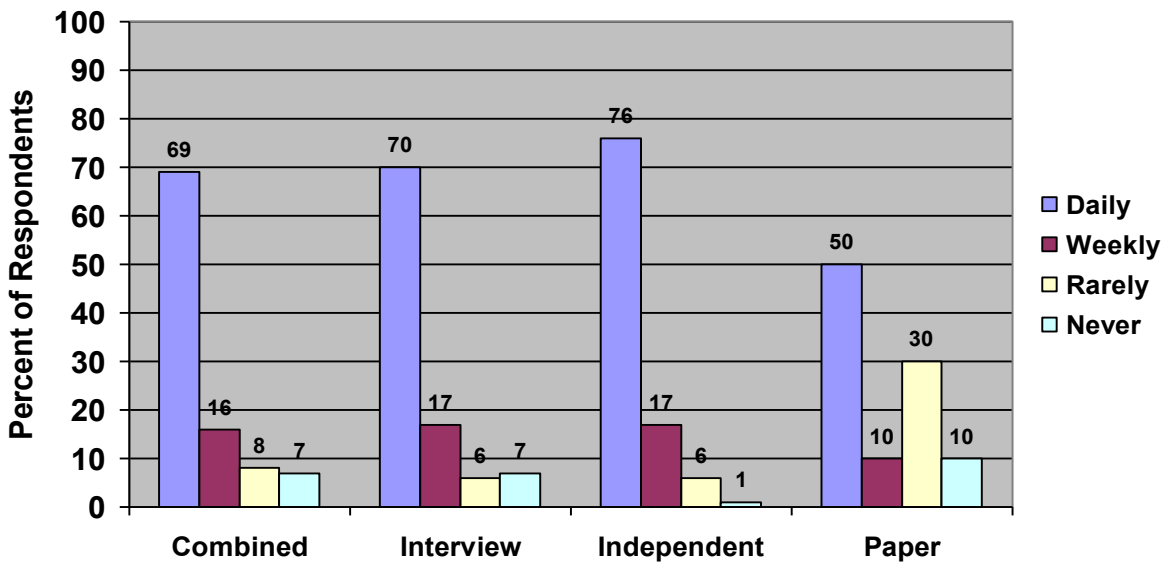


Figure 5: Frequency of computer use by survey respondents

Average time to complete survey

	Kiosk-in-a-Box Interview n=53	SurveyPro Interview n=66	Kiosk-in-a-Box Independent n=28	SurveyPro Independent n=26	Paper n=20
Time (min:sec)	4:09	3:04	3:06	2:41	2:07

Table 3: Average survey completion time

Interview Only

Rate your comfort level during this interview.

	Very Comfortable	Comfortable	Neutral	Uncomfortable	Very Uncomfortable
Interview n=119	27%	65%	8%	0%	0%

Table 4: Results of comfort during interview

Independent Only (*Kiosk-in-a-Box*)

How easy was it to use the touchscreen.

	Very Easy	Easy	Average	Difficult	Very Difficult
Independent n=28	39%	35%	18%	4%	4%

Independent Only (*SurveyPro*)

How easy was it to use the computer.

	Very easy	Easy	Average	Difficult	Very difficult
Independent n=26	73%	23%	4%	0%	0%

Observations

Interviewing Method

Interviewing with both software packages occurred in the main lobby of the museum near the exit across the lobby from the information and ticket booth. There were three interviewers, Anne Bashida, Karin Andreasen, and Kitt Boding. Anne only interviewed one day with *Kiosk-in-a-Box*. Karin and Kitt both conducted interviews with both software packages. The laptop was stationed on a table with two chairs on opposite sides of the table, one for the interviewer and one for the interviewee. The respondent was not able to view the computer screen. A mouse was provided for use with the laptop since the interviewers were uncomfortable with the touchpad. A member of the team was positioned nearby to make observations.

There appeared to be no problems with getting people to be interviewed. Most visitors being interviewed looked happy and laughed a lot during the conversation. People who were not alone brought the group or person they were with along sitting beside them during the interview.

Overall the testing for the interviewing method was successful. A total of one hundred nineteen visitors were interviewed. The staff members who conducted the interviews found both software packages adequately facilitated the interview, but found *SurveyPro* to be generally easier to use and less confining with respect to open responses than *Kiosk-in-a-Box*. For more insight on the experiences of the interviewers look at the summaries in Appendix 5.

Independent Method

The Independent method involved a monitor and keyboard at the information and ticket booth with a sign in front tell to advertise the survey. Both software packages were tested in this situation with a team member nearby to observe. *Kiosk-in-a-Box* was tested using a touchscreen, but *SurveyPro* was tested with a mouse. It was predetermined that the touchscreen would be too difficult for use with *SurveyPro* because the on-screen radio buttons are too small to accurately target on a touchscreen.

After the first day of testing, only two people took the survey, although many were asked. It was believed that visitors needed motivation to take the survey. For the second day a free ticket to the museum was offered as a reward for completing the survey. The free ticket was advertised on the welcome screen of the survey, as well as the project team telling the visitors when asking them to take the survey. This proved more effective in getting people to take the surveys. It was also discovered that more people took the survey when it was moved closer to the information and ticket counter.

Several of the respondents using *Kiosk-in-a-Box* found difficulty in using the touchscreen. The touchscreen was a little wobbly. Most didn't know it was a touchscreen and were searching for a mouse until a team member told them what to do. Using the touchscreen for typing was also a challenge for the visitors, especially the number pad. Some people had trouble with the navigation. They didn't understand they had to press the "Next Question" to go on. The first question in which the survey asks for the main reason for the visit appeared to be confusing for people. They would type in the exhibit that they came to see but the program wouldn't let them go on unless they pressed the button in front of the text box as well which most people didn't do.

Similar problems also occurred using *SurveyPro*. Although a mouse was used instead of the touchscreen, some people still appeared to have difficulty clicking the radio buttons next to the answer. Several people tried to click on the words, not realizing you needed to hit the radio button. There was also the same problem with navigation. Some people did not realize they needed to hit the "Next Question" button to go on. Similarly, some respondents did not realize they needed to hit the "Start" button after selecting their language or to hit the "Finish" button to complete the survey and submit their answers.

Paper Method

The paper questionnaires were distributed at the information and ticket booth. Four clipboards were available for completion of the surveys. No incentive was made for completing the survey but people were willing to take the survey anyway when the information and ticket booth staff asked them. It was easy for groups of people to take the survey at the same time and not have to wait for one another to finish. Because

some of the paper surveys were conducted over the holiday break, nine completed questionnaires were not timed.

Analysis and Discussion

In order to make the appropriate recommendations to the museum for their survey system, the team evaluated several available options for software packages, survey methods, and hardware for survey system. Two software packages as well as three survey methods were field-tested in the museum. This indicates that there are five sets of data: two sets from interviewing (one for each software package), two sets from independent (one for each software package), and one set from paper. The field-testing served a dual purpose of hardware and software evaluation as well as gathering information about the respondents' attitudes and experiences with surveys and computer use. From these surveys there are key questions that were asked about computer use and surveys. These questions can be found in Appendix 3. To study the relationships between various respondent groups and their responses to the survey questions, the team developed hypotheses that can be found in Appendix 7. The following analysis includes an evaluation of the software packages, an evaluation of hardware, and a comparison of the survey methods used.

Software Assessments

The project team's strong familiarity with the two software packages allows for an informed analysis of their functionality. First, the sample survey was created using each of the two software packages. The approach that each piece of software took in creating a survey was noted, as each was very different. Next, the respondent program was field tested in the National Museum where museum patrons took the survey either independently or in an interview format. The layout, interface, and other aspects of each software package's respondent program were markedly different with distinct advantages and disadvantages. Finally, the data collected from field tests were analyzed using each piece of software's intended analysis method. The capabilities of each software package were noted and compared. Through first-hand experience, the advantages and disadvantages of *Kiosk-in-a-Box* and *SurveyPro 3.0* were evaluated.

Pre-assessment Results

Tables 27 through 30 illustrate the results of our preliminary, informal software evaluation and testing. A more formal evaluation was conducted using a binary dominance matrix of software features in table 29. Also, the two chosen software packages were scored using a detailed rubric provided at the end of this chapter. The result is an objective software ranking. By weighting each feature with respect to its relevance and need to the National Museum, each survey software package may be rated objectively.

The binary dominance matrix is essentially a chart that conducts a pair wise comparison between the features listed. The feature that is considered more important to the National Museum receives a 1, while the less important of the two receives a 0. This gives a weight to each feature based on its relative importance among all the features. Thus, the more important the feature is to the National Museum, the higher its weight. Table 30 represents the final software weighting chart that gives a score to each package. The software with the highest score has those features best suited to the National Museum. The two software packages with the highest score based on these criteria were further tested at the National Museum in field tests.

The results of this software pre-assessment were used to select the two software packages that the team believed would best meet the needs of the museum and deserved further evaluation. Table 27 outlines the most basic features of each software package to illustrate those options available. Table 28 is a rough ranking of the three major components of each software package plus a ranking of the respondent interface (attractiveness, robustness). The two packages that ranked the best comparatively are *Survey Pro 3.0* and *Kiosk-in-a-Box*. Based on the criteria rankings provided in Table 29, Table 30 gives each software package a score depending on its percent compatibility with the given criteria. *Survey Pro 3.0* and *Kiosk-in-a-Box* are 84% compatible and 86% compatible respectively, higher than the other four packages in question. Based on these preliminary assessments, it was clear that *Survey Pro 3.0* and *Kiosk-in-a-Box* were the two software packages that should be further tested in the National Museum. The rest of this chapter deals with the evaluation of these two software packages in their survey

creation, respondent, and analysis components as well as the methods and hardware used in field-testing.

Survey Creation

The two software packages, *Kiosk-in-a-Box* and *SurveyPro 3.0*, utilize two distinctly different methods of creating a survey. *Kiosk-in-a-Box* takes a mainly graphical and object-oriented approach to survey creation in an attempt to help non-programmers or relatively novice computer users. *SurveyPro 3.0* takes an approach similar to a Windows application (such as PowerPoint) by using an interface that most computer users are familiar with. The major survey creation methods and differences (particularly the graphical differences) between *Kiosk-in-a-Box* and *SurveyPro 3.0* are best illustrated through screen shots and specific examples.

The overall survey creation layout presented by each piece of software is markedly distinct. *Kiosk-in-a-Box* uses a popup window for most survey editing features such as inserting text/pictures, modifying objects' properties, and adding new screens. This popup editor is illustrated in Figure 6. The project team viewed this as a generally confusing and counterintuitive approach. Since every task is in some way reached through various layers of tabs in the editor, it is difficult to remember how to repeat tasks or even find the desired function in the first place.



Figure 6: User interface for *Kiosk-in-a-Box* survey creation editor

SurveyPro, on the other hand, utilizes menus and icons along the top of the survey editor, similar to most other Windows programs. The editor screen used in *SurveyPro* is seen in Figure 7. Also, right clicking on an item accesses many editing tasks. The project team found this approach simple to use. The methods by which an editing task is done required relatively few steps (i.e. mouse clicks or navigation through tabs) and were thus easy to remember and repeat. Overall, the survey editor layout used by *SurveyPro* is superior to that of *Kiosk-in-a-Box*.

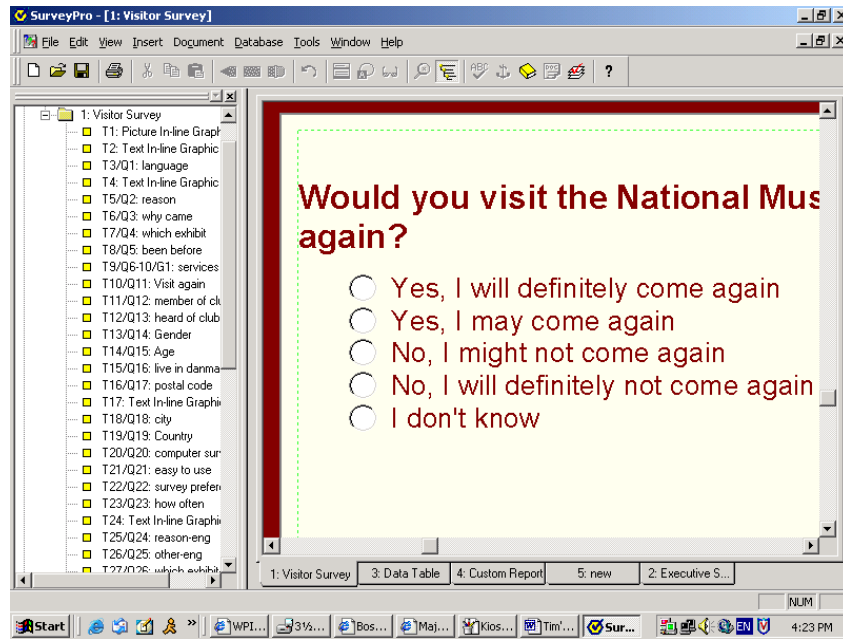


Figure 7: User interface for *SurveyPro* survey creation editor

The assistance provided by each program to aid in survey creation, or lack thereof, varied in type and substance. The only assistance provided by *Kiosk-in-a-Box* was the documentation file provided with the program. This file explained how to create questions of types: single choice, multiple choice, and open-ended. Some general tips on survey style and content were also provided, as well as a sample survey to use for reference. Overall, the documentation was very brief and did not provide the details of survey creation required by the project team. *SurveyPro*, however, provides a "wizard" approach to survey creation if the creator chooses to use it. An example of a wizard screen is shown in figure 8. This tool guides the survey writer through tasks such as adding a new question, adding text/pictures, and changing the overall settings of the respondent interface. The project team found the wizard approach used by *SurveyPro* to be extremely helpful in adding questions and formatting the question screens. This is in stark contrast to *Kiosk-in-a-Box*, where the survey creator does not provide adequate guidance in creating new questions and formatting them appropriately. In this respect, *SurveyPro* is the superior software package in the area of survey creation.

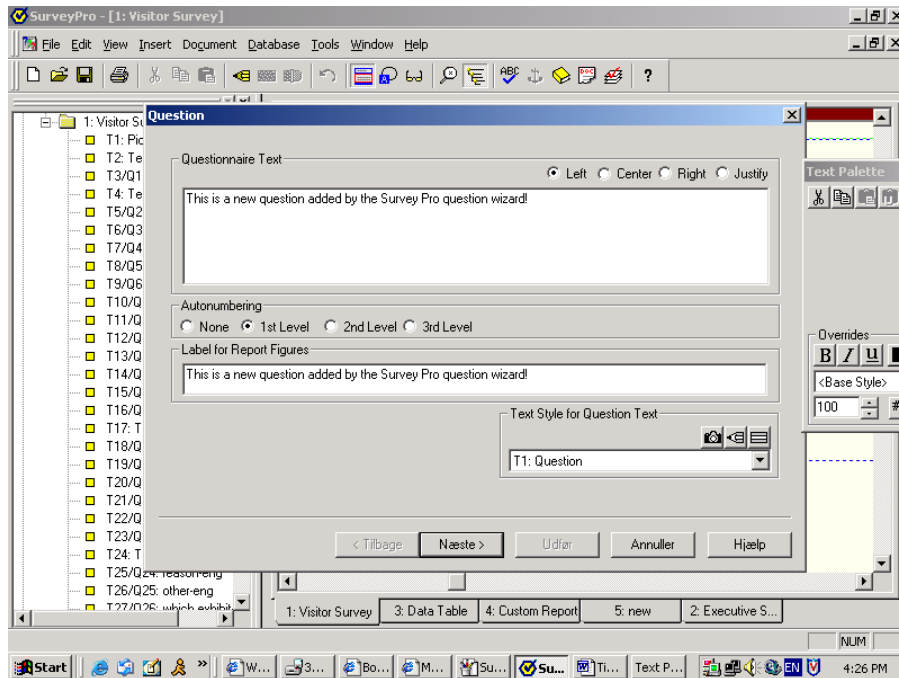


Figure 8: SurveyPro wizard approach

The project team encountered some other noteworthy issues with the two pieces of software with regards to survey creation. In *Kiosk-in-a-Box*, problems were encountered with the operation of button widgets. Buttons could not be used as both survey buttons and action buttons. A survey button is one pressed by the respondent to indicate a response to a question. An action button, when pressed, can activate hidden pictures or text, play a sound or video, or navigate to a new screen. Since buttons could not be configured to do both these functions, the flow of the respondent program could not be controlled well. An example can be seen in figure 9. The project team wanted the top blue survey button, when pressed, to both light up (like a survey button) *and* put the focus of the page on the accompanying text box (like an action button) for respondent input. This could not be done, thus the text box had to be manually clicked by the respondent when input was needed. This frequently confused respondents and was viewed as a major problem by the project team.



Figure 9 *Kiosk-in-a-Box* respondent screen

The ability to create a survey in multiple languages proved to be more complicated than expected. The method used by *Kiosk-in-a-Box* is essentially to create separate *Access* databases for each language. The data could easily be pooled by merging the separate *Access* databases. *SurveyPro* takes a slightly different approach. In *SurveyPro*, the master survey is created in one language, then duplicated and translated into the alternate language, creating two identical (but translated) questionnaires. Regardless of which language the respondent chooses to take the survey in, the data is pooled together with the data from the other language.

Respondent Program

The data collection screens, or the program used by the respondent to answer the survey questions, differ greatly between *Kiosk-in-a-Box* and *SurveyPro 3.0*. *Kiosk-in-a-Box* is meant to be displayed full screen with large buttons and other objects for possible use with a touchscreen. *SurveyPro's* respondent program is built off current HTML technology that greatly influences the flexibility and robustness of the interface in both positive and negative ways. The major differences between the respondent screens of each program are illustrated through the following descriptions and screen shots.

One major element of each piece of software's respondent program was its compliance with touchscreen use. *Kiosk-in-a-Box* is designed run at an 800x600 resolution, making for larger text, pictures, and any other objects. Also, the buttons on the respondent screens are large enough to be easily pressed using a touchscreen. As the name implies, *Kiosk-in-a-Box* is specifically tailored towards a touchscreen kiosk interface. Thus, the graphical aspects of the respondent interface work very well in a touchscreen or kiosk environment. An example of a typical *Kiosk-in-a-Box* respondent screen is seen in figure 9.

The fact that the respondent aspect of *SurveyPro* is based on HTML is a factor in the overall appearance. *SurveyPro* makes use of the same widgets used in web pages. Namely, radio buttons, check boxes, dropdown menus, and others are used for respondent input. An example of a typical *SurveyPro* input screen that uses these radio buttons is shown in figure 10. These input devices are rather small and cannot be resized, making it very difficult to use with a touchscreen, since a very accurate touch on the screen would be required. They are, however, ideal for use with a mouse. With respect to the compatibility of each software package with a touchscreen, *Kiosk-in-a-Box* is the better choice.

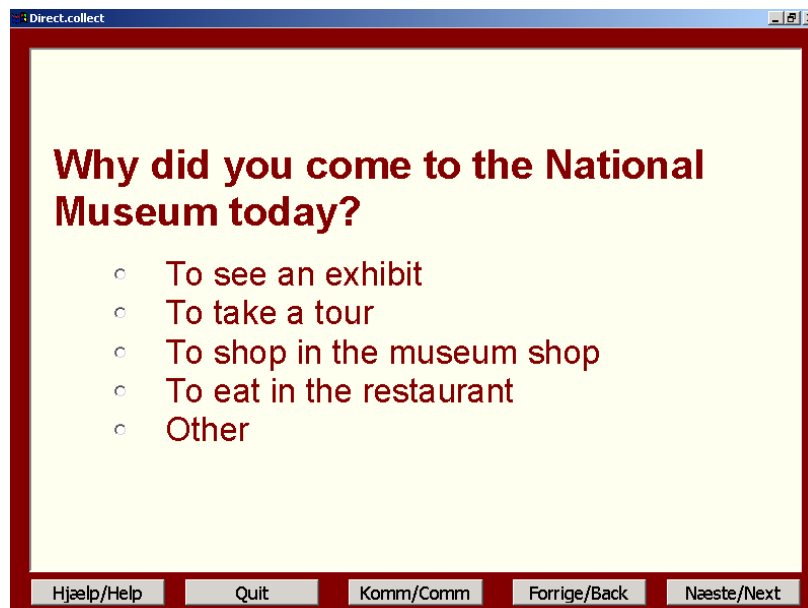


Figure 10: *SurveyPro 3.0* respondent screen (note small radio buttons to left of text)

Another aspect of the respondent facet of the two software packages is the program's resiliency to user error or improper use. Since the program should have the

ability to be used by patrons without the supervision of a staff member, it should not allow the respondent to crash the computer or enter the underlying operating system. The project team found that both programs are flawed in this respect. *Kiosk-in-a-Box* is run in a full screen mode with no available on-screen exit buttons. The respondent can, however, exit the program by using control-alt-delete or access Windows by using the Windows keyboard button. This was observed several times while running independent testing with *Kiosk-in-a-Box*, especially among children and teenagers who were trying to access the Internet. There are programs that disable the control-alt-delete function, but to the best of the project team's knowledge, there is no straightforward method of disabling the Windows key. *SurveyPro* has the same problems as *Kiosk-in-a-Box* with one additional drawback. The window in which *SurveyPro* is displayed may be resized and even closed very easily by the respondent. The project team views this as a major problem which, in effect, does not allow *SurveyPro* to be used unattended in a kiosk. Both programs have serious shortcomings in limiting respondent access to the system, but *Kiosk-in-a-Box* is the more secure of the two.

Software Analysis Capabilities

The analysis methods and capabilities of *SurveyPro 3.0* and *Kiosk-in-a-Box* highlight the largest differences between the two pieces of software. It is within this realm that the project team noted the largest gap between the two packages. It is based on this category that one piece of software truly stood apart from the other. The programs' abilities in handling the collected respondent data and displaying the results in an appropriate manner is the final step in the surveying process. Conclusions can be drawn more easily from a better display and analyzing capability of the respondent data. Based on the project team's work with the two pieces of software, the analysis capabilities and potential shortcomings of each piece of software are summarized below.

The most apparent difference between the two software packages with regards to data analysis is the layout of the analysis suite. In short, *Kiosk-in-a-Box* saves respondent data in the form of a *Microsoft Access* database, whereas *SurveyPro* saves respondent data in its own custom format. *Kiosk-in-a-Box* offers no assistance in analyzing the data stored in the *Access* database. Rather, the data must be organized and

analyzed either in *Access* or exported to *Excel*. From *Access* or *Excel*, the user has very good control over manipulating the appearance of data-derived graphics. A sample screen of the data collected from *Kiosk-in-a-Box* is shown in figure 11.

Time	Date	Reason for vis	Which exhibit	Other reason	Has Visited	Facilities
10:22:10 AM	4/8/2003	Exhibit	Text		yes1	Good
11:25:54 AM	4/8/2003	Exhibit	Jordens folk	Text	yes2	Good
12:25:08 PM	4/8/2003	Exhibit	Text	Text	yes1	Not Relevant
12:44:15 PM	4/8/2003	Exhibit	Verdens Historie	Text	yes3	Good
1:49:54 PM	4/8/2003	Exhibit	Text	Text	yes2	Good
1:53:38 PM	4/8/2003	Exhibit	egypten	Text	yes2	Good
1:59:17 PM	4/8/2003	Other	Text	Text	yes3	Good
11:09:37 AM	4/9/2003	Exhibit	hele museet	Text	yes2	Very Good
11:19:46 AM	4/9/2003	Exhibit	se udstillingen o	mødes med ven	yes2	Very Good
11:36:44 AM	4/9/2003	Exhibit	børne ting	Text	yes3	Average
11:39:04 AM	4/9/2003	Exhibit	Text	Text	yes1	Average
11:41:54 AM	4/9/2003	Exhibit	Text	Text	yes2	Very Good
11:47:29 AM	4/9/2003	Exhibit	Barnse	nej	No	Average
11:50:31 AM	4/9/2003	Exhibit	barnse	Text	No	Average
12:01:58 PM	4/9/2003	Restaurant	Text	Text	yes3	Not Relevant
12:35:25 PM	4/9/2003	Exhibit	Text	Text	yes1	Not Relevant
12:43:41 PM	4/9/2003	Exhibit	Danmarkshistori	Text	yes2	Good
12:45:59 PM	4/9/2003	Exhibit	ethnografisk	Text	yes3	Very Good
1:35:27 PM	4/9/2003	Shop	Text	Text	yes1	Very Good
1:43:54 PM	4/9/2003	Other	Text	gratisdag	yes2	Good
3:17:36 PM	4/9/2003	Tour	Text	Text	yes1	Very Good

Figure 11: *Kiosk-in-a-Box* data format in *MS Access*

The analysis capabilities of *Kiosk-in-a-Box* are in stark contrast to *SurveyPro*, which offers a multitude of analysis options. Basic analysis of the respondent data is immediately available in an executive summary. This summary gives the basic statistical breakdown of each question such as number of responses and percentages, as well as some graphical representations such as bar charts and tables. Beyond the executive summary, the project team was able to create detailed custom analysis reports. Some of the capabilities of *SurveyPro*'s analyzer include: comparing the results of two questions for statistical significance using chi-square, confidence intervals, and standard errors; comparing subsets of data with results displayed graphically; and finally, data can be exported to *Microsoft Access* or an ASCII³ file. Also, the user has as much ability to manipulate data-derived graphics as in *Excel* or *Access*. A screen shot of a custom report

³ American Standard Code for Information Interchange

in *SurveyPro* is shown in figure 12. In summary, *SurveyPro 3.0* provides a very powerful data analysis suite, whereas *Kiosk-in-a-Box* provides no support in data analysis.

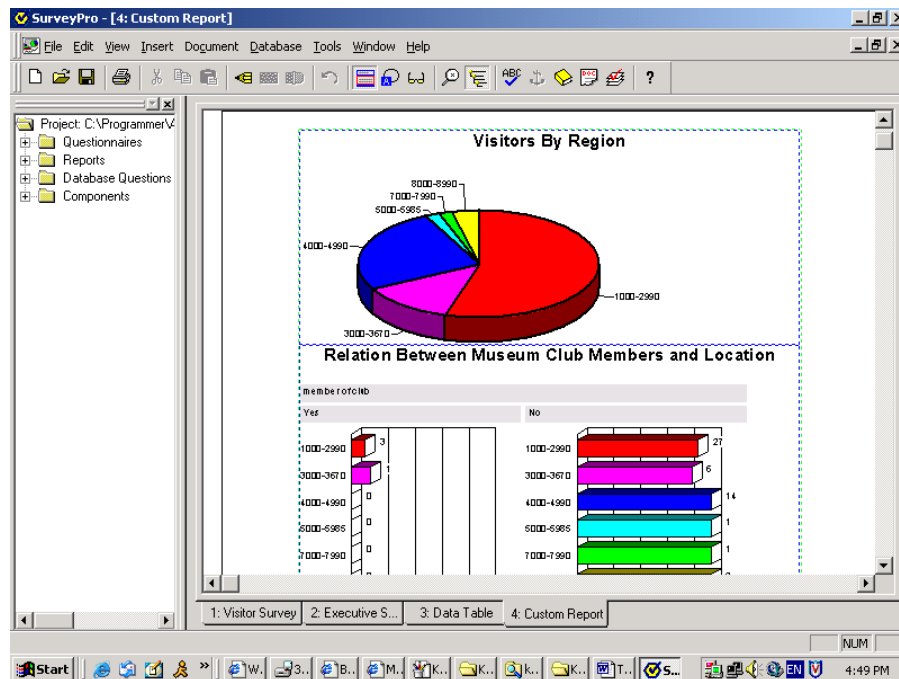


Figure 12: Sample of *SurveyPro 3.0* analysis screen

Survey Data Analysis

SurveyPro 3.0

Along with an instant executive summary with the totals and percentages of all of the respondent's answers, *SurveyPro 3.0* has a very powerful data analyzer that quickly and easily produces tables, charts, graphs, and other figures that can represent the collected data. One very useful feature is that two or more questions can be compared on the same figure to view their relationship. For even more advanced, yet simple, analysis, statistical measures can be applied to these figures such as mean, standard deviations, confidence intervals, standard error, and chi-squared correlations. The data can also be exported to other programs, such as *Excel*, to perform more complex analysis. The purpose of this section is to demonstrate the functionality of the program. Because of the small sample size, the actual significance of the statistics may not be strong. The analysis covers only the data sets collected in *SurveyPro* for the interview method.

The automatically produced executive summary displays graphically the response break down of each question asked. Figure 13 and Figure 14 show the graphs of responses to two questions asked in the interview survey. Figure 13 shows the results of the question asking if the visitor has been to the museum before (question 3). Figure 14 is the results of the questions asking the visitor to rate each of the museum services (question 5). For this question, the executive summary scores each answer from 5 (excellent) to 1 (very poor) and provides a mean score.

been before			
	Counts	Percents	Percents
			0 100
Nej	19	28.8%	
Ja, sidste år	13	19.7%	
Ja, tidligere i år	12	18.2%	
Ja, inden for de sidste 3 år	11	16.7%	
Ja, over 3 years ago	11	16.7%	
Totals	66	100.0%	
Mean	--		

Figure 13: Sample *SurveyPro* executive summary table (single choice)

services	Meget God	God	Hverken Eller	Dårlig	Meget Dårlig	Ikke Relevant	Totals	Replies	Mean
Betjeningen i informationen og billetsalget	9.0 13.6%	13.0 19.7%	1.0 1.5%	0.0 0.0%	0.0 0.0%	43.0 65.2%	66.0 100.0%	66.0	4.35
Betjeningen i Museumsbutikken	4.0 6.1%	12.0 18.2%	4.0 6.1%	1.0 1.5%	0.0 0.0%	45.0 68.2%	66.0 100.0%	66.0	3.90
Udvalget af varer i Museumsbutikken	4.0 6.1%	22.0 33.3%	6.0 9.1%	1.0 1.5%	0.0 0.0%	33.0 50.0%	66.0 100.0%	66.0	3.88
Betjeningen i restauranten	0.0 0.0%	9.0 13.6%	1.0 1.5%	0.0 0.0%	0.0 0.0%	56.0 84.8%	66.0 100.0%	66.0	3.90
Udvalget på menukortet i restauranten	1.0 1.5%	3.0 4.5%	2.0 3.0%	3.0 4.5%	0.0 0.0%	57.0 86.4%	66.0 100.0%	66.0	3.22
Whole Group	3.6 5.5%	11.8 17.9%	2.8 4.2%	1.0 1.5%	0.0 0.0%	46.8 70.9%	66.0 100.0%	66.0	3.87

Figure 14: Sample *SurveyPro* executive summary table (question group)

One very useful feature is that data, such as postal codes, can be grouped together by any criteria desired. Because this can be done after the survey is completed

and the data are collected, the survey writer does not need to determine the desired grouping until he/she wishes to analyze the data. The grouping can also be easily changed at any time. Figure 15 is a pie chart displaying the visitors who took the survey by postal code region. In the survey, the respondents were asked to enter their four digit postal code. Once the data were collected, groups were established to pool the zip codes into several regions. This is useful in that we can now see that more than 50% of the museum visitors come from the greater Copenhagen area (postal codes 1000-2990). The numbers below the postal code region refer to number of respondents and percentage of respondents, respectively.

Visitors By Region

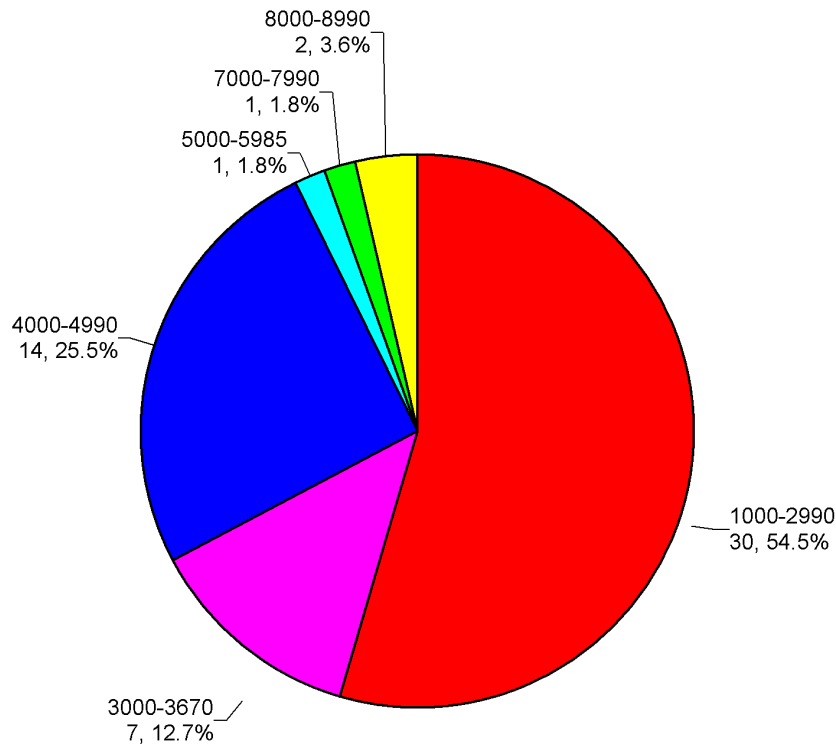


Figure 15: Pie chart displaying the postal code breakdown of guests that live in Denmark

Figure 16 is a comparison between home postal code and membership. This figure is comprised of two charts. The first is the people who are members of the Museum Club broken down by their postal code region. The frequency on the bottom axis shows the percentage of people from that region that participated in the survey that are members of the Museum Club. We see here that although more people that are

members of the Museum Club are from the 1000-2990 postal code region, a greater percentage of people from the 3000-3670 postal code region are members of the club. The numbers to the right of the bars are the number of respondents that fit that category. Even though these are observations that the museum might be able to make according to the data, the sample size is too small for it to be statistically valid as a conclusion.

Relation Between Museum Club Membership and Postal Code

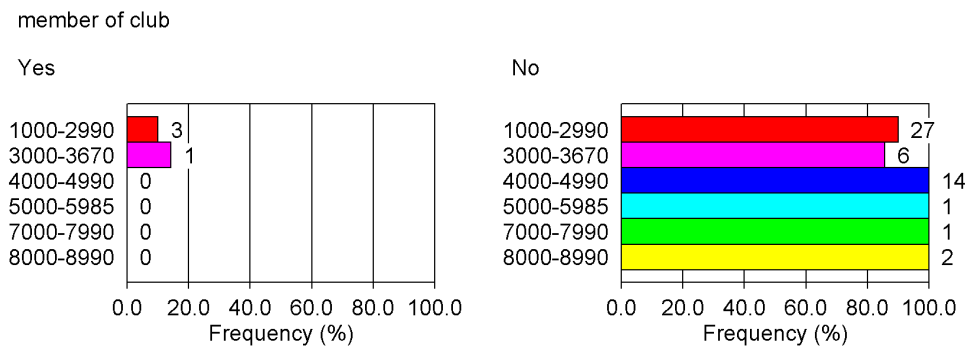


Figure 16: Bar graphs showing the postal code breakdown of members of the Museum Club (left) and non-members (right)

Figures 17 and 18 are two different comparisons of how well respondents found the services of the museum (question 5) and their likeliness to return (question 6). The five possible responses, ranging from very good to very poor, were given values of 5 to 1, respectively. This is used to compute a mean score for particular service, or all of the services combined. Figure 17 is a bar graph showing the combined services mean score compared to the respondents' likeliness to return. The numbers to the right of the bars are the mean score, followed by the number of respondents. The respondents who said they would definitely return gave the services a mean score of 3.88 (of 5) while the respondents who said they would probably return gave the services a mean score of 3.81. There is a slight difference in numbers, and this may or might not be significant. To determine this, a confidence interval or a chi-squared can be run to see if in fact there is a strong relationship. Figure 18 shows the 95% standard error of the mean and the chi-squared value of significance. It is shown that the 95% standard error of mean is ± 0.21 for people who say they will definitely return. This says that 95% of the data fall within

± 0.21 of the mean score. It is also shown that the chi-squared value is less than 50%. This means that there is less than a 50% probability that the two questions are significantly related. The comment regarding a low cell count below figure 18 indicates that the sample size is too small for an accurate chi-squared test. Refer to the chi-squared section in the background chapter for further explanation.

Relation Between Services Mean Score and Likeliness to Return

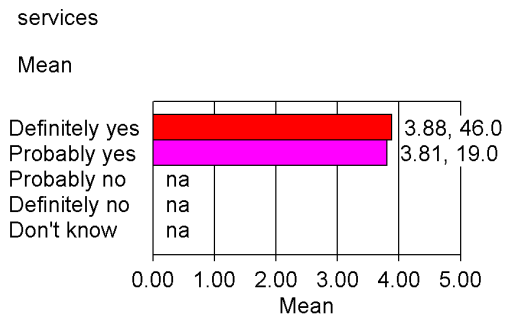


Figure 17: Bar graph displaying the mean score of the museum services broken down by respondents' likeliness to return

Relation Between Services Mean Score and Likeliness to Return

	Visit Again		
	Definitely yes	Probably yes	Probably no
services			
Mean	3.88	3.81	-
Mean Error*	± 0.21	± 0.54	\pm
ChiSq Significance	Under 50%*		

* Note: Mean error covers 95% of distribution. ChiSq has over 20% low count cells.

Figure 18: Table showing the 95% standard error of mean and the chi-squared significance measure

Figures 19 and 20 are two graphs that display the relationship between age and Museum Club membership (top) and the relationship between age and Museum Club awareness (bottom). This shows the age breakdown of the respondents who are club members and the respondents who have heard of the club. The numbers to the right of the bars are the number of respondents that fit that category.

Relationship Between Age and Museum Club Membership

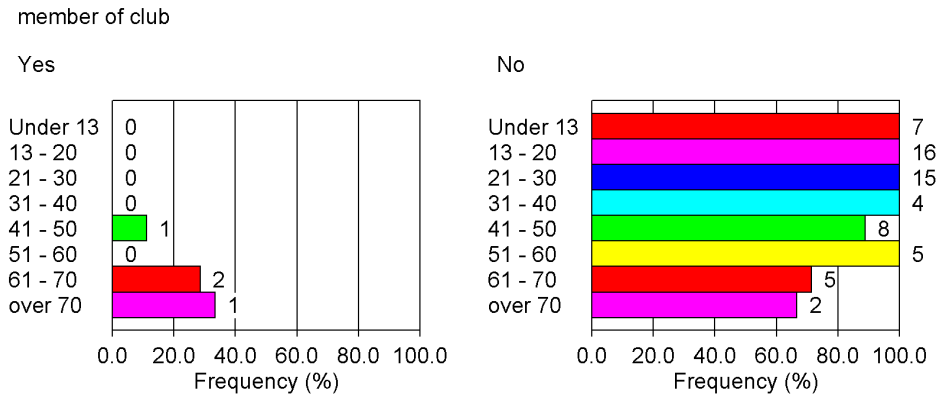


Figure 19: Bar graphs showing the age breakdown of members of the Museum Club (left) and non-members (right)

Relationship Between Age and Knowledge of Museum Club

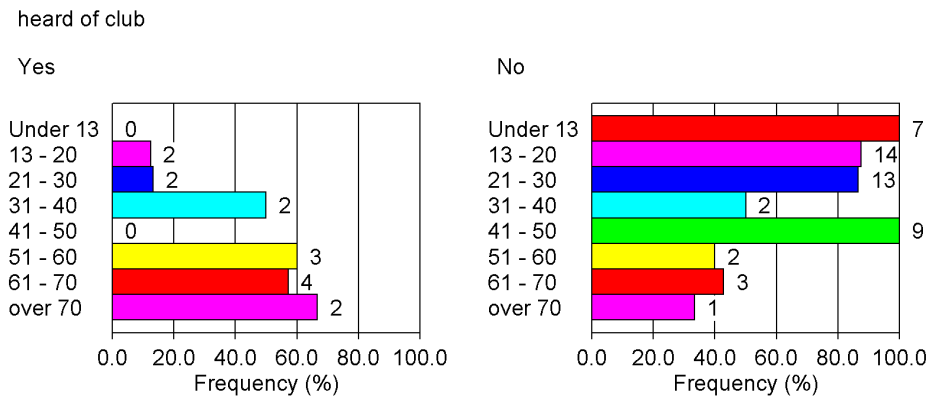


Figure 20: Bar graphs showing the age breakdown visitors who heard of the Museum Club (left) and visitors who haven't (right)

The figures and tables in this section demonstrate the analysis capabilities of *SurveyPro* to easily organize and compare data in a clear and graphical or tabular format. Since the sample sizes are small, the results are not statistically valid for making conclusions. This section is available as an example for the museum to refer to when making their final decision regarding software selection.

Kiosk-In-A-Box

Kiosk-in-a-Box does not have a statistical analyzer, nor does it provide an executive report displaying totals or percentages all of the respondents' answers. It stores its data into a *Microsoft Access* database. The data can be analyzed using *Access* or can be exported to another statistical analyzer. Since the project team and also the museum staff are familiar with *Excel*, only a brief overview will be given on how to create graphs and statistical measures using *Excel*.

Using *Excel*, many powerful graphs and statistical measures can be produced, similar to the ones produced above with *SurveyPro*. However, this process is very lengthy. Instead of simply choosing a question to graph, many steps need to be taken in order to arrange the raw data in a way that will produce the desired results. First, all other data must be filtered out so that only the desired question (or questions) data are visible. This sorting and grouping is easily done in *Access* and then imported into *Excel*. *Access* is very powerful in that it can apply filters and sorting patterns to arrange the data in the desired way. From there, graphs can be produced from the sorted data. Also, scoring the responses, as in the questions rating the museum services (question 5), need to be manually coded and computed. Another drawback is that answers need to be manually grouped together. It is not possible to set a rule and have all the answers determined by that rule grouped into another named answer, as the postal codes were in *SurveyPro*. The statistical measures that can be performed in *Excel* are quite extensive, including ANOVA, T-tests, and other complex tests. However, these functions require a good understanding of statistics to be used properly.

Analysis of Computer Related Survey Questions

As part of the assessment of the survey software, hardware, and methods, the last group of questions in the survey from field-testing was used to assess the respondents' reactions to taking the survey. Since both software packages and all three methods needed to be statistically analyzed, all the data were pooled together in an *Excel* database. It was determined that a chi-square test of association and an ANOVA analysis were the appropriate tests for analysis. See the Background chapter for a discussion of basic statistic concepts. However, *Excel* could only perform the ANOVA test, so a web-

based chi-square calculator was used for all the chi-square tests for association (Ball, 2003). Although the calculator is useful, it doesn't inform the user as to whether or not their sample size is large enough for an accurate chi-square value. It will however not perform a test if all of one row or column has cell values of zero. Refer to the Statistics section in the Background chapter for more information on low cell or sample counts. A full list of hypotheses and results of tests are incorporated in Appendix 7 as well as a few sample calculations for the chi-square test.

Software

The objective of this analysis is to detect any evidence of significant differences between the two software packages that were tested in the independent and interview methods. It was important to note if the visitors respond differently to each software package, and the time it took to complete the surveys. Analysis on the data collected in this section was done using a chi-square test for significant associations in data sets taking into account the survey software and method it was used in. Hypotheses were formed before the data were collected. The hypotheses are stated in the null form, which means that they are stated without bias as to the results of the analysis. There are three hypotheses in this section of analysis on the differences between the software packages and using them in the independent and interview methods.

Tests for Software Bias

The first hypothesis states that there is no difference in the responses made to each software package in the independent method. In order to analyze this hypothesis the data were put into tabular form with the number of people who answered each choice per software package. This is shown in tables 36, 37, and 38 in Appendix 7. The questions used for the analysis in order of appearance are: Have you taken a computer survey before?, How do you prefer to be surveyed?, and How often do you use a computer?.

With these analyses, the team attempted to find proof of a bias according to which software package was being used. Comparing the responses to the aforementioned questions' answers with the software used for the response resulted in a less than

significant chi-square value. A sample calculation can be found in Appenix 7 as well as the results for this analysis. This means that according to the data, there is no relationship between the software packages and the answers that the respondents made. Thus there is no evidence of biases in sampling of the respondents using the software packages.

Software vs. Time for Survey Completion: Independent Method

The second hypothesis states that there is no difference in the time it takes to complete the independent survey with the different survey packages. Since this analysis has to do with time, and time is a continuous variable with an expected normal distribution, an ANOVA analysis was performed. Table 5 contains the data for the analysis of this hypothesis.

Anova: Single Factor

SUMMARY					
<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>	<i>Standard Error</i>
SurveyPro 3.0	26	22:00	2:41	0:01	0:08
Kiosk-in-a-Box	28	15:06	3:06	0:01	0:08

ANOVA							
<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>	
Between Groups	0.0041	1	0.0041	4.695	0.03	4.027	
Within Groups	0.0454	52	0.0009				
Total	0.0495	53					

Table 5: ANOVA of time versus software with independent method

Things to note in this table are the averages and p-value. In this case the p-value, which is the probability that the hypothesis is true, is less than 0.05 and greater than 0.01. There is a 3% probability that there is no significant difference indicating that there is a 97% probability that there is a significant difference between the averages. According to table 2 this value indicates that there is moderate evidence for a significant difference between the averages of the times for survey completion in the independent method by each software package. *Kiosk-in-a-Box* has a greater average time. From these data, the team concludes that on average *Kiosk-in-a-Box* requires a significantly greater amount of time than *SurveyPro* to complete a survey.

There are several possibilities as to why *SurveyPro* requires less time to complete than *Kiosk-in-a-Box*. One reason might be the fact that people were using a mouse with *SurveyPro* and a touchscreen, which may have been less familiar, with *Kiosk-in-a-Box*. The second reason could be that in *SurveyPro*'s question format it was possible to include more than one question per page making fewer page turns. The third reason could be that the survey question format was easier to read and navigate resulting in answering the questions faster. These are possible reasons for the differences in times, but for more conclusive evidence a more in-depth study would need to be conducted.

Software vs. Time for Survey Completion: Interview Method

The third hypothesis in the analysis of the software is that there is no difference in the time it takes to complete the interview survey with the different survey packages. The same ANOVA analysis was formed as previously with hypothesis two. The data for this analysis can be found in table 6.

Anova: Single Factor

SUMMARY

<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>	<i>Standard Error</i>
SurveyPro 3.0	66	10:47	3:04	0:03	0:08
Kiosk-in-a-Box	53	4:24	4:09	0:04	0:11

ANOVA

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	0.0602	1	0.0602	21.42	0.00001	3.92
Within Groups	0.3288	117	0.0028			
Total	0.3890	118				

Table 6: ANOVA of time versus software for interview method

Things to note in this table are the averages and p-value. In this case the p-value, which is the probability that the hypothesis is true, is less than 0.01. There is a less than 1% probability that there is no significant difference indicating that there is over a 99% probability that there is a significant difference between the averages. According to table 2 this value indicates that there is very strong evidence for a significant difference

between the averages of the times for interview completion by each software package. *Kiosk-in-a-Box* has a greater average time. From these data, the team concludes that on average *Kiosk-in-a-Box* required a significantly greater amount of time than *SurveyPro* to complete an interview.

In addition to the reasons given for the differences in times in hypothesis two of this section, there might also be some other interview biases. These could be that there was a sampling bias among the interviewers choosing people who they thought would give more opinions. Other bias could come from the fact that there were three interviewers, all performing the interviews in a slightly different manner. Because of this no further conclusions could be made about the reasons for the difference in the times for interview completion between software packages.

Hardware

Aiding in the evaluation of the survey software and methods is the evaluation of possible hardware for the surveys. The use of a touchscreen for conducting independent visitor surveys was the issue under evaluation. Only *Kiosk-in-a-Box* was tested in this manner. The following tests were performed in order to help in making conclusions as to whether or not the museum should use a touchscreen to administer visitor surveys. Analysis on the data in this section was done using the chi-square test for significant differences. Not all eight hypotheses tested resulted in significant results so only those that did are included here and numbered according to the Analysis Plan in Appendix 7.

Ease of Use of the Touchscreen vs. Computer Experience

The second hypothesis in the Analysis Plan is that there is no difference in the ease of use of the touchscreen with varying levels of computer experience. The data for this hypothesis can be found in table 7. The rows indicate how often the respondent uses a computer and the columns indicate the level of difficulty in using the touchscreen.

With this comparison, it can be found whether there is a correlation between a person's past experience with computers and their ease in using the

touchscreen. A question that could be answered is: Does experience and familiarity with computers aid in using a touchscreen?

Hypothesis 2: Ease of touchscreen use vs. Computer experience						
	Very easy	Easy	Average	Difficult	Very Difficult	Total
Daily	8	8	4	0	0	20
Weekly	3	0	1	0	1	5
Once in a while	0	2	0	0	0	2
Never	0	0	0	1	0	1
Total	11	10	5	1	1	28

Table 7: Results of ease of touchscreen use versus computer experience

Degrees of freedom: 12

Chi-square = 38.49

p is less than or equal to 0.001.

The distribution is significant.

In this case the p-value, which is the probability that the hypothesis is true, is 0.001. There is a 0.1% probability that there is no significant difference indicating that there is a 99.9% probability that there is a significant association between the data sets. According to table 2 this value indicates that there is very strong evidence that there is a relationship between a respondent's past computer experience and their level of ease in using the touchscreen. Even though the test doesn't say what type of relationship these two questions have, the table of data shows that more experienced computer users find the touchscreen easier to use. Note however that the number of respondents in most of the cells in this test are very small so this isn't an accurate chi-square test.

Ease of Use of Touchscreen vs. Age Group

The eighth hypothesis is that there is no difference in ease of use of the touchscreen with any particular age. The data for this hypothesis can be found in table 8. The rows indicate the level of difficulty experienced by the respondent and the columns indicate the age group.

With this comparison, it can be found whether there is a correlation between the age of the respondent and their ease of using the touchscreen. A question that could be answered is: Is a touchscreen easier or harder to use for a person of a particular age?

Hypothesis 8: Age vs. Ease of touchscreen use									
	Under 13	13 to 20	21 to 30	31 to 40	41 to 50	51 to 60	61 to 70	Over 70	Total
Very easy	0	2	3	1	4	0	1	0	11
Easy	2	1	2	0	2	2	1	0	10
Average	1	1	0	2	1	0	0	0	5
Difficult	0	0	0	0	0	0	0	1	1
Very Difficult	0	0	1	0	0	0	0	0	1
Total	3	4	6	3	7	2	2	1	28

Table 8: Results of age versus ease of touchscreen

Degrees of freedom: 28

Chi-square = 45.40

p is less than or equal to 0.025.

The distribution is significant.

In this case the p-value, which is the probability that the hypothesis is true, is less than 0.05 and greater than 0.01. There is a 2.5% probability that there is no significant difference indicating that there is a 97.5% probability that there is a significant association between the data sets. According to table 2 this value indicates that there is moderate evidence for significant relationship between the age group of the respondent and the ease of use level of the touchscreen according to the respondent. With the small amount of data collected it is hard to see what type of relationship these two questions have. It seems though, from rough observation, that the middle-aged people found the touchscreen easier to use than the young or old people. However, the chi-square test is not statistically accurate due to the low sample counts.

Methods

Three methods were field-tested in the National Museum: independent, interview, and paper. First, tests were performed to detect biases among the survey methods. If there was a bias then for the later hypotheses involving those questions, the methods were evaluated separately according to method. For the tests with the three methods to be evaluated, a test of association was conducted between questions and then compared between methods to evaluate biases that might exist between these methods. There should be no significant difference in the responses between the methods.

Survey Method vs. Time to Complete Survey

The first hypothesis is that there is no difference in the time it takes to complete the surveys between each survey method. The analysis data for this hypothesis can be found in table 9. There are five sets of data. The analysis is separated by software as well as method because of the results from hypothesis three in the software analysis section. From that hypothesis it was learned that there is a significant difference between the software packages and the time it took to complete the surveys so they can't be pooled together for this analysis of methods.

Anova: Single Factor

SUMMARY

<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>	<i>Standard Error</i>
Independent: Kiosk-in-a-Box	28	15:06	3:06	0:01	0:08
Independent: SurveyPro	26	22:00	2:41	0:01	0:08
Interview: SurveyPro	66	10:47	3:04	0:03	0:08
Interview: Kiosk-in- a-Box	53	4:24	4:09	0:04	0:11
Paper	11	23:18	2:07	0:02	0:19

ANOVA

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	0.1187	4	0.0297	13.46	0.00001	2.42

Within Groups	0.3948	179	0.0022
Total	0.5135	183	

Table 9: ANOVA of method versus time

In this case the p-value, which is the probability that the hypothesis is true, is less than 0.01. There is a less than 1% probability that there is no significant difference indicating that there is over a 99% probability that there is a significant difference between the averages. According to table 2 this value indicates that there is very strong evidence for a significant difference between the average times it took to complete the survey and which method and software was being used. Because there are two things that this test is dependent on, software and method, a pair-wise comparison must be done to find out if it is all of these data sets that are different from each other or just certain ones. Two of these pair-wise comparisons have already been reported in the software section of this analysis.

Anova: Single Factor

SUMMARY

<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>	<i>Standard Error</i>
Independent: SurveyPro	26	22:00	2:41	0:01	0:08
Interview: SurveyPro	66	10:47	3:04	0:03	0:08

ANOVA

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	0.0047	1	0.0047	2.32	0.13	3.95
Within Groups	0.1818	90	0.0020			
Total	0.1864	91				

Table 10: ANOVA results for analysis with *SurveyPro* between methods

The first pair-wise comparison is between the interviewing and independent method using *SurveyPro*. Table 10 shows the ANOVA analysis results. In this comparison, the p-value is 0.13. There is a 13% probability that there is no significant difference indicating that there is a 87% probability that there is a significant difference between the averages. According to table 2 this value indicates that there is no significant evidence that there is a difference in the average time it takes to complete a

survey in *SurveyPro* in the interviewing and independent method. A larger sample size is needed to more accurately determine whether such a relationship exists.

Anova: Single Factor

SUMMARY

<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>	<i>Standard Error</i>
Interview: Kiosk-in-a-Box	53	4:24	4:09	0:04	0:11
Independent: Kiosk-in-a-Box	28	15:06	3:06	0:01	0:08

ANOVA

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	0.0350	1	0.0350	14.33	0.0003	3.96
Within Groups	0.1925	79	0.0024			
Total	0.2274	80				

Table 11: ANOVA results of the analysis with *Kiosk-in-a-Box* between methods

The second pair-wise comparison is between the interviewing and independent method using *Kiosk-in-a-Box*. Table 11 shows the ANOVA analysis results. In this comparison, the p-value, which is the probability that the time averages are true, is less than 0.001. There is less than a 0.1% probability that there is no significant difference indicating that there is more than a 99.9% probability that there is a significant difference between the averages. According to table 2 this value indicates that there is very strong evidence that there is a significant difference in the average time it takes to complete a survey in *Kiosk-in-a-Box* in the interviewing and independent method.

Overall the interviewing with each software package took longer than in the independent (only *Kiosk-in-a-Box* had a significant difference) and paper methods because the respondents were able to talk as long as they wanted. They made more comments than they would have if they were typing or writing. It also takes longer to ask a question than to read it. The paper surveys took the least amount of time because people were able to see all the questions at once making it easy to skim the questionnaire

while answering the questions. The independent method takes more time than the paper method because of the changing screens for almost every question. It takes less time than the interviews because people make fewer comments when they have to type or write them.

Survey Method Preference vs. Survey Method

The fourth hypothesis is that there is no difference in a person’s survey method preference and the survey method used to complete this survey. The data for this hypothesis can be found in table 12. The rows indicate the method of surveying used. The columns indicate the respondent’s preference for being surveyed. The data for all respondent sets are pooled since no significant relationship was found in the tests for differences between the individual respondent data sets.

Hypothesis 4: Survey preference vs. Survey method used					
	Computer	Paper	Interview	No preference	Total
Independent	32	6	2	14	54
Interview	18	5	56	40	119
Paper	2	12	1	5	20
Total	52	23	59	59	193

Table 12: Results of survey preference versus survey method

Degrees of freedom: 6

Chi-square = 102.6

p is less than or equal to 0.001.

The distribution is significant

In this case the p-value, which is the probability that the hypothesis is true, is 0.001. There is a 0.1% probability that there is no significant difference indicating that there is a 99.9% probability that there is a significant association between the data sets. According to table 2 this value indicates that there is very strong evidence for a significant association between survey method preference and the method the survey is administered. Looking at the table it seems to show that a lot of respondents said they preferred to take a survey in the same method they answered the question in (i.e. the

people taking the computer survey prefer to be surveyed on a computer, etc.). This can also be seen in figure 4. The statistical analysis verifies that the trends shown there are significant.

Computer Experience vs. Survey Method

The fifth hypothesis is that there is no significant association between a respondent’s computer experience and the method in which they took the survey. The data for this hypothesis can be found in table 13. The rows indicate the method of surveying used. The columns indicate how often the respondent uses a computer. The two software package data sets are pooled in this analysis since it was previously discovered that there isn’t a relationship between the answers to the questions and the software being used.

Hypothesis 5: Survey method vs. Computer experience					
	Daily	Weekly	Once in a while	Never	Total
Independent	41	9	3	1	54
Interview	83	20	7	9	119
Paper	10	2	6	2	20
Total	134	31	16	12	193

Table 13: Results of survey method versus computer experience

Degrees of freedom: 6

Chi-square = 17.08

p is less than or equal to 0.01.

The distribution is significant.

In this case the p-value, which is the probability that the hypothesis is true, is 0.01. There is a 99% probability that there is a significant association between the data sets. According to table 2 this value indicates that there is very strong evidence that there is a significant association between the survey method used and the amount of computer experience of the respondent. The data doesn’t clearly show what type of relationship this analysis proves. The only observation that is clear is that in all methods there high percentage of people who use a computer daily.

Computer Survey Experience vs. Survey Method Preference

The sixth hypothesis for this section is that a person's previous computer survey experience makes no difference in a person's preference in being surveyed. The data for this hypothesis are in tables 14, 15, and 16. There are three sets of data in the table, one for each method. The methods are separated because according to hypothesis four in this section there is a significant association between the respondent's survey method preference and the method they took the survey in. The rows indicate whether or not the respondent has taken a computer survey before and the columns indicate their survey method preference.

With this comparison, it can be found whether there is a correlation between a person's experience with computer surveys and their preference for being surveyed. Such questions that could be answered are: Does past experience with computer surveys affect a person's preference with regards to survey techniques? With past experience in computer surveying does a person still prefer to be surveyed by computer?

Independent:

Hypothesis 6: Computer survey experience vs. Survey preference					
	Computer	Paper	Interview	No preference	Total
Yes	17	1	2	3	23
No	15	5	0	11	31
Total	32	6	2	14	54

Table 14: Results of computer survey experience versus survey preference for independent method

Degrees of freedom: 3

Chi-square = 8.36

p is less than or equal to 0.05.

The distribution is significant

Interview:

Hypothesis 6: Computer survey experience vs. Survey preference					
	Computer	Paper	Interview	No preference	Total
Yes	10	3	19	17	49
No	8	2	37	23	70
Total	18	5	56	40	119

Table 15: Results of computer survey experience versus survey preference for interview method

Degrees of freedom: 3

Chi-square = 3.51

For significance at the .05 level, chi-square should be greater than or equal to 7.82.

The distribution is not significant.

p is less than or equal to 1.

Paper:

Hypothesis 6: Computer survey experience vs. Survey preference					
	Computer	Paper	Interview	No preference	Total
Yes	1	2	0	2	5
No	1	10	1	3	15
Total	2	12	1	5	20

Table 16: Results of computer survey experience versus survey preference for paper method

Degrees of freedom: 3

Chi-square = 2.04

For significance at the .05 level, chi-square should be greater than or equal to 7.82.

The distribution is not significant.

p is less than or equal to 1

When comparing computer survey experience with survey method preference, the independent method's p-value, which is the probability that the hypothesis is true, is less than 0.05. Thus, there is over 95% probability that there is a significant association between the data sets. According to table 2 this value indicates moderate evidence for a significant relationship found in the independent method but not the interview or paper methods. It is hard to say why these are the results. It might be because the independent method is the only one in which the respondent is in direct contact with a computer. This might result in influencing the answers to these two questions relating surveying and computers in surveying. Note, however, that all of these comparisons are conducted with small samples and this low cell counts, as the significance of the results may be inaccurate.

Survey Method Preference vs. Computer Experience

The seventh hypothesis is that there is no difference in a person's preference for being surveyed with varying levels of computer experience. The data for this hypothesis can be found in table 17, 18, and 19. There are three sets of data, one for each method. The methods weren't pooled together because as the previous hypotheses show, there is a significant relationship between the method and the answers to both the questions being compared in this hypothesis. The rows indicate how often the respondent uses a computer and the columns indicate their preference for being surveyed.

With this comparison, it can be found whether there is a correlation between a person's past experience with computers and which method of surveying is preferred. A question that could be answered is: Does experience and familiarity with computers affect a person's preference with regards to survey methods?

Independent:

Hypothesis 7: Survey Preference vs. Computer Experience					
	Computer	Paper	Interview	No preference	Total

Daily	28	2	2	9	41
Weekly	3	2	0	4	9
Rarely	1	2	0	0	3
Never	0	0	0	1	1
Total	32	6	2	14	54

Table 17: Results of survey preference versus computer experience for independent method

Degrees of freedom: 9

Chi-square = 18.36

p is less than or equal to 0.05.

The distribution is significant.

Interview:

Hypothesis 7: Survey preference vs. Computer experience					
	Computer	Paper	Interview	No preference	Total
Daily	14	3	39	27	83
Weekly	3	1	9	7	20
Rarely	1	0	3	3	7
Never	0	1	5	3	9
Total	18	5	56	40	119

Table 18: Results of survey preference versus computer experience for interview method

Degrees of freedom: 9

Chi-square = 3.35

For significance at the .05 level, chi-square should be greater than or equal to 16.92.

The distribution is not significant.

ρ is less than or equal to 1.

Paper:

Hypothesis 7: Survey preference vs. Computer experience					
	Computer	Paper	Interview	No preference	Total
Daily	1	5	0	4	10
Weekly	1	0	1	0	2
Rarely	0	6	0	0	6
Never	0	1	0	1	2
Total	2	12	1	5	20

Table 19: Results of survey preference versus computer experience for paper method

Degrees of freedom: 9

Chi-square = 19.4

ρ is less than or equal to 0.025.

The distribution is significant.

When comparing survey preference and computer experience, the p-value, which is the probability that the hypothesis is true, is 0.05. There is a 5% probability that there is no significant difference indicating that there is a 95% probability that there is a significant association between the data sets. According to table 2 this value indicates that there is moderate evidence for a significant relationship in the independent method. There is no evidence for a significant relationship between survey preference and computer experience in the interview method. However, in the paper method, the p-value, which is the probability that the hypothesis is true, is 0.025. There is a 2.5% probability that there is no significant difference indicating that there is a 97.5% probability that there is a significant association between the data sets. According to table 2 this value indicates there is very strong evidence for a significant association between survey preference and computer experience in the paper method. Some of these results are probably due to the small sample size and should be considered with that fact in mind.

When looking at the independent method data it seems that there is a relationship between respondents who use the computer daily preferring computer surveys. There aren't enough data in any of the other sections to make any further conclusions.

Computer Experience vs. Age Group

The ninth hypothesis is that there is no difference in computer experience with varying age. The data for this hypothesis is in table 20, 21, and 22. There are three sets of data, one for each method. The software data was pooled together since from previous hypotheses it was learned that there is no significant difference in the answers to the questions between software packages. The rows indicate how often a respondent uses a computer and the columns are the age group.

With this comparison, it can be found whether there is a correlation between a person's age and how often they use a computer. A question that could be answered is: Is age a factor in the amount of computer use a person has?

Independent:

Hypothesis 9: Age vs. Computer experience									
	Under 13	13 to 20	21 to 30	31 to 40	41 to 50	51 to 60	61 to 70	Over 70	Total
Daily	1	3	12	9	6	7	3	0	41
Weekly	1	2	2	2	1	1	0	0	9
Rarely	1	0	0	0	0	1	1	0	3
Never	0	0	0	0	0	0	0	1	1
Total	3	5	14	11	7	9	4	1	54

Table 20: Results of age versus computer experience for independent method

Degrees of freedom: 21

Chi-square = 67.68

p is less than or equal to 0.001.

The distribution is significant.

Interview:

Hypothesis 9: Age vs. Computer experience									
	Under 13	13 to 20	21 to 30	31 to 40	41 to 50	51 to 60	61 to 70	Over 70	Total
Daily	4	15	20	8	9	8	10	9	83
Weekly	2	3	3	4	4	2	1	1	20
Rarely	1	1	1	0	1	2	2	0	8
Never	1	3	1	0	0	2	2	0	9
Total	8	22	25	12	14	14	15	10	120

Table 21: Results of age versus computer experience for interview method

Degrees of freedom: 21

Chi-square = 17.56

For significance at the .05 level, chi-square should be greater than or equal to 32.67.

The distribution is not significant.

p is less than or equal to 1.

Paper:

Hypothesis 9: Age vs. Computer experience

	Under 13	13 to 20	21 to 30	31 to 40	41 to 50	51 to 60	61 to 70	Over 70	Total
Daily	0	1	5	2	2	0	0	0	10
Weekly	1	0	0	1	0	0	0	0	2
Rarely	1	0	2	0	0	1	2	0	6
Never	0	0	0	0	0	0	1	1	2
Total	2	1	7	3	2	1	3	1	20

Table 22: Results of age versus computer experience for paper method

Degrees of freedom: 21

Chi-square = 28.83

For significance at the .05 level, chi-square should be greater than or equal to 32.67.

The distribution is not significant.

p is less than or equal to 0.20.

When comparing age groups to computer experience, the p -value, which is the probability that the hypothesis is true, is 0.001. There is a 0.1% probability that there is no significant difference indicating that there is a 99.9% probability that there is a significant association between the data sets. According to table 2 this value indicates that there is very strong evidence that there is a significant relationship between age and computer experience in the independent method but no evidence for a relationship in the interview or paper method. There aren't enough data here to make any conclusions about the results found but it is likely that this is an artifact due to the small sample sizes.

Since this analysis section not only shows the capabilities of statistical analysis, there are some significant conclusions to be taken into account when selecting survey software, hardware, and survey methods. In testing it was found that the software only differed in the time to complete the survey and not in data collected. *Kiosk-in-a-Box* takes longer in both methods (interview and independent). If time is of importance then according to the data collected *SurveyPro* will best suit the museum.

With regard to hardware, a touchscreen maybe an option for the museum in the future. With such a low sample count it is hard to make any definite conclusions about the use of a touchscreen. However, from the field-testing data, people find the

touchscreen easier to use with more computer experience. It is also the middle-aged people that find the touchscreen the easiest among the tested age groups.

According to the methods analysis in this section, time differs between methods but only significantly with *Kiosk-in-a-Box*. If time to complete surveys is of importance to the museum paper surveys are the fastest as well as being the easiest to administer more than one at a time. It was also found that people prefer to be surveyed in whatever method they took the survey in. This could mean that the surveys will be taken by people who like being surveyed in that method. This introduces survey method bias. It however is also worthwhile to note that there was no age bias between the methods which is unexpected and probably due to low sample sizes. It was expected that there would be less old people taking the computer survey than younger people, but that difference was not evident in the data collected.

Software Functionality Assessment Summary

In evaluating any software package it is important to have a rubric of criteria to follow as a standard so as not to incorporate any subjective opinions in the final evaluation. Understanding the importance of this, the team has developed a software evaluation rubric in Appendix 2 that can be used to evaluate any survey software package. The rubric was formed after great considerations of the importance of different functionalities. The categories of such functionalities are: cost, flexibility, user support, company websites, survey creator, survey response, and survey analyzer. Assessment criteria were identified for each category, and the categories were weighted for importance.

Using the software evaluation rubric in Appendix 2, scores were given for each criterion for both software packages. The score was determined by the descriptions next to each criterion in the rubric. Table 23 shows the scorings of both software packages corresponding to the software evaluation rubric.

Category	Criterion	Score	
		Kiosk-in-a-Box	SurveyPro
Cost	Price	4	4
	Features	3	4
	<i>Average</i>	<i>3.50</i>	<i>4.00</i>
Flexibility	Kiosk	4	2
	Platform	2	4
	Branching	4	4
	<i>Average</i>	<i>3.33</i>	<i>3.33</i>
User Support	Help	2	4
	Tech Support	3	4
	Documentation	3	4
	<i>Average</i>	<i>2.67</i>	<i>4.00</i>
Company Website	Links	4	4
	Browser	4	4
	Multimedia	4	4
	Reliability	3	4
	<i>Average</i>	<i>3.75</i>	<i>4.00</i>
Survey Creator	Navigation	1	3
	Feedback	4	4
	Answer Fields	2	4
	Saving	2	4
	Wizard	2	4
	Languages	3	4
	Likert Scales	2	4
	Open Ended	4	3
	Single Choice	3	4
	Multiple Choice	3	4
	<i>Average</i>	<i>2.60</i>	<i>3.80</i>
	Survey Response	Navigation	3
Start Screen		4	3
Picture Support		3	3
Picture Supply		3	1
Text		4	4
Color		3	3
<i>Average</i>		<i>3.33</i>	<i>3.00</i>
Survey Analyzer	Graphs	1	4
	Reports	1	4
	Export Data	3	3
	Built-in Analyzer	1	4
	<i>Average</i>	<i>1.50</i>	<i>3.75</i>

Table 23: Software evaluation raw scores based on assessment rubric

Table 24 is the summary of the results of the evaluation of each software package. The weight of each criterion was determined by the importance of that aspect to the museum. The average score for each criterion was multiplied by the criterion's weight to determine the criterion's weighted score. The weighted scores were then totaled to determine a final score for the software package.

Category	Average		Weight	Weight x Category Average	
	Kiosk-in-a-Box	SurveyPro		Kiosk-in-a-Box	SurveyPro
<i>Cost</i>	3.50	4.00	15%	0.525	0.600
<i>Flexibility</i>	3.33	3.33	10%	0.333	0.333
<i>User Support</i>	2.67	4.00	10%	0.267	0.400
<i>Company Website</i>	3.75	4.00	5%	0.188	0.200
<i>Survey Creator</i>	2.60	3.80	20%	0.520	0.760
<i>Survey Response</i>	3.33	3.00	20%	0.667	0.600
<i>Survey Analyzer</i>	1.50	3.75	20%	0.300	0.750
<i>Total</i>			100%	2.80	3.64

Table 24: Weighted decision matrix for software assessment

Kiosk-in-a-Box had a final score of 2.80, while *SurveyPro* had a final score of 3.64. By the software evaluation rubric, *SurveyPro* appears to be the most appropriate software package for the National Museum.

Recommendations

Software Selection

After very careful consideration, the project team has chosen to recommend to the National Museum *Apian SurveyPro 3.0*. The key factors in this decision were the evaluation using the software evaluation rubric evaluation, reports from the interviewers, information sessions held with Karin Andreasen, and the project team's own personal experience having worked extensively with the software on a daily basis.

The software evaluation rubric was created to incorporate each feature of a software package that would be of importance to the museum. There, the project team could objectively score each aspect of several software packages to provide a numeric value of each package. After completing the evaluations of both *Kiosk-in-a-Box* and *SurveyPro 3.0* using the rubric, it was clear that *SurveyPro* was more suitable to the museum's needs than *Kiosk-in-a-Box*. The key features that proved *SurveyPro* superior were survey creation, analysis, and customer support.

Another valuable aspect to the project team's decision was the opinion of the staff members that used the software in conducting the interview tests with the visitors. These views were very valuable in that they provided the project team quality feedback from personnel that would be using the software in the museum. The consensus from the three interviewers was that *SurveyPro* was very easy to use, simple and attractive in design, and very useful in facilitating a productive and informative interview. The program's ability to enter additional comments at any time during the survey proved to be a very useful feature that was frequently used during the testing.

The project team also conducted information sessions with Karin to show her the survey creation interface and the data analysis capabilities of both *Kiosk-in-a-Box* and *SurveyPro*. Karin found the creation of surveys in *Kiosk-in-a-Box* to be very confusing and difficult to learn. She also was disappointed in the lack of ability to create analysis reports, graphs, or comparisons within the program. On the other hand, she was very satisfied with the ease of survey creation in *SurveyPro* and found it to be very methodical in approach. Karin was also very impressed with the quality of the automatic data analysis reports and the ability to quickly and easily create custom graphs and

reports. In her opinion, *SurveyPro* seemed to be the more appropriate software package for use for future surveys in the museum.

The last criteria used to determine the final software recommendation was the personal experience of the project team. By learning how to use each software package to create and administer surveys and analyze the results, the project team developed quite strong opinions of each. These views are very similar to those of the survey interviewers. The team also found *Kiosk-in-a-Box* to be quite confusing in survey creation and was very difficult to learn. The team also felt that exporting the data to another program to analyze added to the complexity of the overall system. *SurveyPro* however was felt to be far superior in the ability to learn, ease of survey creation, and data analysis. The team was also very satisfied with the quality and ease of use of the contained statistical and data analyzer. The last and most important feature necessary to the museum the project team explored is Multilanguage support. *Kiosk-in-a-Box* is not specifically designed for surveys in multiple languages, can the questionnaires can be manipulated during creation to accomplish this. However, the results for each language are stored in separate databases. On the other hand, *SurveyPro* is designed for surveys in multiple languages and the results from each language can stored together.

The *SurveyPro* software is very valuable to the museum in that it can be used for paper, interview, and independent kiosk surveying. Paper surveys are created by simply adding questions and arranging them on the questionnaire. Although the data must be entered into the computer manually, it can be entered directly into *SurveyPro* using its Answer Entry mode. The benefit is that the data can be immediately compiled and analyzed using its own analyzer. The same executive reports and data analysis figures can be produced as if the survey was directly conducted on the computer.

SurveyPro is also very suitable to assist in conducting interviewing method surveys. Surveys can be created in a very similar manner as a paper survey, and the interviewer enters the answers to the respondent's questions as they are reported. This is very useful in that it eliminates the time it takes to enter the data in the computer. It is also very conducive to interviewing because of its ability to capture more information than directly asked. The comment feature allows the interviewer to enter in any additional information the respondent has to offer. This added information is a very

important aspect of the interviewing method and *SurveyPro* does an excellent job in facilitating this requirement.

SurveyPro is also designed to be used to administer a survey in an independent kiosk setting. The main advantage here is that the data are entered into the computer directly from the respondent and this method does not require a staff member to assist in the survey process. Currently, though, there are some aspects of the programs that need to be improved in order for full use in this setting. These include the respondent being able to close the survey and the inability to choose the appropriate survey to take, as in a multilingual survey. However, solutions to these problems are in development and will be available in product updates for future use in the museum.

Another strong reason that lead to the recommendation of *SurveyPro* was it has a self-contained statistical and data analyzer, which is used in the same way regardless of survey method. The analyzer automatically produces an executive summary, graphically displaying the results of the survey when the survey is complete. This is very valuable to the museum in that it is very similar to reports produced for the results of past paper surveys that took weeks to produce. It is also able to produce custom reports with fully customizable charts, tables, and graphs. Statistical measures, such as standard mean error, confidence intervals, and chi-square can be very quickly and easily performed. The analyzer is a very powerful tool that can provide a great extent of useful information for the National Museum.

Implementation

After selecting the software that best fits the National Museum, the next step is recommending how to implement the system. *SurveyPro 3.0* may be used in all forms of visitor surveys conducted by the National Museum. Therefore, this section is devoted to highlighting how the museum could best use *SurveyPro 3.0* in the three methods of surveying that are possible: paper and pencil surveys, interviews, and an independent kiosk setup.

Paper Surveys

Of the visitor surveys previously conducted in the National Museum, all have been paper surveys distributed to patrons by a staff member. The method of sampling entailed staff members asking every other individual (or group) exiting an exhibition to take the survey. After roughly 2,000 surveys were filled out, all responses were manually entered into *Microsoft Excel* for analysis. Analysis included simple statistics such as counts and averages.

SurveyPro 3.0 can both expedite and facilitate the process of conducting visitor surveys using the paper distribution method. First, paper surveys can be easily created, edited, formatted, and printed using *SurveyPro*. The surveys may then be distributed in a high-traffic area for patrons in order to maximize the sample size. The prior museum method of using a table with chairs (or a clipboard) and sampling every other patron is a good method. The next area that *SurveyPro* is helpful is the entry of patron response data into the computer. An electronic form of the paper survey is displayed and may be quickly filled out one survey at a time by a staff member. Once all the data have been entered into *SurveyPro*, powerful analysis may be performed in the form of a customizable results report. Counts and percentages, such as those analyses historically performed by the National Museum, are immediately available in an executive summary. More advanced analysis such as comparing of question responses or correlation studies are easily performed as well.

One of the major advantages of distributing paper surveys is that multiple patrons can take the survey simultaneously. This is a key advantage in augmenting the sample size. The biggest drawback of paper surveys is the amount of time required by museum staff to hand out surveys and then enter the respondent data into *SurveyPro*. Using *SurveyPro* surely aids in creating and analyzing paper surveys, but still requires a fair amount of time to enter in all patron responses. The time required by personnel to enter in respondent data of one 10-15 question survey into *SurveyPro* is approximately 30 seconds. This would take approximately 9-10 hours of continuous data entry by a staff member. Using this method to conduct visitor surveys requires the purchase of *SurveyPro 3.0* (\$450, 3.000 DKK), the cost of paper and clipboards, as well as the time of a staff member to distribute the surveys and data entry.

Interviews

Interviewing patrons for feedback on the museum has the advantage of person-to-person contact that the other two surveying methods lack. This can be a major advantage as the interviewer has the opportunity to probe the respondent beyond what static surveys are capable of doing. It is recommended that those staff members who will conduct face-to-face interviews first refer to the Background Chapter on interviewing techniques and read the Smithsonian Institute's Manual for Interviewers (Smithsonian Institute, 2003). These document proper etiquette for interviewing and help the interviewer better assess the respondent.

We recommend that an interviewing "station" be set up in a high-traffic patron area similar to the setup used for paper surveys. The station should include a table with two chairs facing each other. The interviewer sits with a laptop facing away from the respondent. *SurveyPro* is used to create the survey and the *DirectCollect* feature is used to enter in responses. The interviewer uses a mouse to choose responses on the direct collect screens and the laptop keyboard to enter in any open-ended responses and/or comments. In this way, respondent data are entered directly into the *SurveyPro* database. The layer of overhead created in paper surveys where respondents answer questions on paper and a staff member reenters the data into *SurveyPro* is eliminated. Data analysis may then be performed on the collected data in the same manner as in the paper survey method mentioned above.

The largest advantage of an interviewing method is the face-to-face contact aspect. Also, the direct entering of responses into the computer eliminates overhead. Among the disadvantages of conducting interviews is the large amount of time required by staff to conduct the interviews. Also, only one interview can be performed at a time. In this respect, the amount of time taken by patrons to be interviewed is matched by staff commitment time. The average time for one interview to be conducted of a questionnaire of 10-15 questions takes approximately three minutes. To conduct 1,000 interviews would require approximately 50 hours of staff commitment. Using this method to conduct visitor surveys requires the purchase of *SurveyPro 3.0* (450\$, 3.000 DKK), a laptop computer, as well as the time required by staff to conduct the interviews.

Kiosk

The third and final recommendation to the National Museum for upgrading their visitor survey system is to use a stand-alone kiosk. The premise behind this method involves museum patrons taking a survey on their own at a computer station running *SurveyPro 3.0 DirectCollect*. This method is similar to the paper survey method in that respondents enter in their responses themselves. The difference, however, is that respondents enter data directly into *SurveyPro*, eliminating the step of reentering respondent data into *SurveyPro* by a staff member.

The location of a survey kiosk station must be, once again, in a high-traffic patron area to maximize the response rate. The hardware used entails a computer running *SurveyPro*, a monitor, a mouse, and a keyboard. The computer should be hidden from patrons and only accessible to staff. The monitor should be behind glass or plastic so as to protect it from abuse. The cords attaching the mouse and keyboard to the enclosure should be reinforced to prevent abuse or theft. The keyboard may be covered with a plastic cover to keep it clean and reusable. Finally, the enclosure, or kiosk, should be attractive with a sign inviting patrons to share their feedback.

Based on the project team's experience with this form of testing, it is rather difficult to entice patrons to take a computer survey, even when directly asked. It is recommended that strong motivation is provided for patrons to take the kiosk survey. Some examples are: free ticket to the museum, chance to win gifts, or entry into a raffle.

It must be noted that, in its current state, *SurveyPro 3.0* is not entirely adequate for use in a kiosk setting. The largest problem, as noted in the Software section of the Analysis Chapter is the user's ability to close *SurveyPro* and access restricted areas of the computer. Apian Software is, however, working to correct this problem. The project team is hopeful that a kiosk-compatible version of *SurveyPro* will soon be available.

The largest advantage of using an independent kiosk setup for conducting visitor surveys is the fact that no staff members are required to administer surveys or enter respondent data. The respondent enters all data directly into *DirectCollect*. In essence, the museum should be able to create a survey in *SurveyPro*, leave the survey for patrons to complete in the museum, and when enough responses have been gathered,

analysis can be performed. The largest disadvantage of a kiosk implementation is the cost of all the hardware required for the physical setup. Another, more obvious disadvantage is the fact that *SurveyPro 3.0* is not yet fully usable in a kiosk setting. Using a kiosk is the most different among the three methods recommended, but it also has the largest range of advantages and disadvantages. The cost of implementing a kiosk survey system would include the cost of *SurveyPro 3.0* (\$450, 3.000 DKK), the cost of a computer and accompanying hardware including a monitor, keyboard, and mouse, a kiosk enclosure, and perhaps the price of prizes or free tickets.

Conclusion

After fourteen weeks of research and testing of various survey techniques, conclusions and recommendations were devised based on the needs of the National Museum. Various methods of software evaluation such as interviews, development and evaluation of a rubric, and personal experience led us to a final software recommendation. The project team recommended a possible implementation for an upgraded, more efficient survey system based on field tests completed at the National Museum.

After conducting research, field-tests, and information sessions with the museum staff, the project team was able to produce various conclusions and recommendations. First, and most importantly, was a final survey software recommendation of *Apian SurveyPro 3.0* to assist in improving the quality of visitor survey administration. Next the project team provided a variety of conclusions of ways to effectively administer a survey, including techniques for three different methods: paper, independent kiosk, and interview. These conclusions include specific implementations in the National Museum with respect to hardware, location, and staff requirements. Lastly, the team offered a plan for following up on the research done and how to integrate the recommendations into their future survey campaign. Based on the research conducted in Worcester and the testing and analysis completed in Denmark, the project team was able to recommend an efficient method for conducting visitor surveys in the National Museum of Denmark.

Appendices

A1 Institutions Researched

Institutions Researched

Geographical	Large Institutions	Known Software users
Worcester Art Museum Andover Historical Society Concord Museum Battleship Cove Boston Museum of Science The Springfield Museums Ecotarium Boston Museum of Fine Arts	Museum of Modern Art New England Aquarium San Diego Zoo Computer Museum of America Museum of Flight Philadelphia Museum of Art Audubon Institute American Museum of Natural History California Academy The Dr. Pepper Museum	Smithsonian The Cleveland Museum of Art The Chicago Museum of Science and Industry

Table 25: Institutions contacted

Sample email to Institutions

To Whom this may concern,

My name is Arianne Brooks, and I am contacting you for information about your institution’s visitor survey methods. I am part of a team from Worcester Polytechnic Institute that has been contracted by the National Museum in Copenhagen, Denmark to assist them in improving their visitor survey system. In order to better assist them, I would like to talk with one of your staff who is involved with visitor surveys. If this is possible, could you please respond as soon as possible with the appropriate contact information. Thank you for your time and consideration.

Sincerely,

Arianne Brooks

Interview with Institutions

- I. State Objective of the interview
- II. What method of visitor surveys does your institution conduct?
 - a. Reasons for method used?
 - b. Software
 - i. What type/brand of software is used?
 - ii. Is the software used by the staff to conduct the survey or is it a stand alone program? Is the software used in the creation, implementation, and/or the analysis of the survey?
 - iii. What is the reason for using that specific software?
 - iv. What steps did the institution first take to integrate the system?
 - c. Describe the physical setup of the survey system
- III. Individuals surveyed
 - a. How frequently does the institution survey visitors?
 - b. What information is the institution hoping to gain from the surveys?
 - c. What do you do with the results from the survey?

Sample Table of Surveying methods at other institutions

		Worcester Art Museum
Method		Pencil and Paper
Reason		Easy for volunteers to administer
Software	Type	Excel
	Role	Analysis
	Reason	Tabulated for sending to company to analyze and send back results
Physical System		Consists of volunteers asking visitors at the exits of exhibits to fill out a paper questionnaire. Offer discounted membership and one free pass.
Respondent		Anyone who is willing to take the time to fill out survey at the exit of an exhibit.

Table 26: Sample table of surveying methods at other institutions

A2 Software Pre-Assessment

Software Pre-assessment Tables

Name	Web/PC Based	Platform	Cost	Results Data Format	Questions Support: Likert Scales	Questions Support: Open Ended	Includes Statistical Analyzer?
<i>Survey Said</i>	Both	Web or Java application	\$700 - \$1,000 (4.865 – 6.950 DKK)	Custom	Yes	Yes	Yes
<i>SurveySolutions XP</i>	Web	Web, e-mail	\$500 - \$1,000 (3.475 – 6.950 DKK)	Custom	Yes	Yes	Yes
<i>Apian – SurveyPro 3.0</i>	Both	Web, e-mail, CD, stand-alone (kiosk)	\$1,200 - \$1,800 (8.340 - 12.510 DKK)	Custom	Yes	Yes	Yes
<i>StatPac</i>	Web	Web, e-mail	\$1,000 (6.950 DKK)	Custom	Yes	Yes	Yes
<i>Survey System</i>	Both	Web, e-mail, kiosk	\$1,300 - \$2,100 (9.035 – 14.595 DKK)	Custom	Yes	Yes	Yes
<i>Kiosk-in-a-Box</i>	PC	Kiosk	\$495 (3.440 DKK)	Access Database	No	Yes	No

Table 27: Preliminary Software Comparison Matrix

Name	Ease of use: Survey creator	Ease of use: Respondent	Ease of use: Analyzer	Respondent Interface	Total
Survey Said	5	5	4	6	20
SurveySolutions XP	2	3	3	5	13
Apian SurveyPro 3.0	1	2	1	2	6
StatPac	2	6	5	3	16
Survey System	6	4	2	3	15
Kiosk-in-a-Box	4	1	6*	1	12

Table 28: Preliminary Software Comparison Matrix (cont.)

* Kiosk-In-A-Box does not include a statistical analyzer. It compiles the data in a Microsoft Access database.

<i>Criteria</i>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total	Weighting
1 Cost	0	1	1	1	1	1	0	1	0	0	0	1	1	1	1	10	0.095
2 Question Branching	0	0	0	1	1	0	0	1	0	0	0	1	1	1	1	7	0.067
3 Touchscreen Compatibility	0	1	0	1	1	0	0	1	0	0	0	1	0	1	1	7	0.067
4 Proven In Other Institutions	0	0	0	0	0	0	0	1	0	0	1	1	1	1	1	6	0.057
5 Easy Survey Creation	0	0	0	1	0	0	0	1	0	0	1	1	1	1	1	7	0.067
6 Attractive Respondent Interface	0	1	1	1	1	0	1	1	0	0	0	1	1	1	1	10	0.095
7 Comprehensive Data Analysis	1	1	1	1	1	0	0	1	0	0	1	1	1	1	1	11	0.105
<i>Question Support:</i>																	
8 Likert Scales	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	3	0.029
9 Open-Ended	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	13	0.124
10 Single Choice	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	14	0.133
11 Multiple Choice	1	1	1	0	0	1	0	1	0	0	0	1	1	1	1	9	0.086
12 Comments	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0.010
<i>Multimedia:</i>																	
13 Pictures	0	0	1	0	0	0	0	1	0	0	0	1	0	1	1	5	0.048
14 Video	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0.010
15 Sound	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0.010
																105	1.000

Table 29: Binary Dominance Matrix

Criteria	Weighting	Software Compatibility %					
		Survey Said	SurveySolutions XP	SurveyPro 3.0	StatPac	Survey System	Kiosk-in-a-Box
10 Single Choice	0.133	100	100	100	100	100	100
9 Open-Ended	0.124	100	100	100	100	100	100
7 Comprehensive Data Analysis	0.105	60	70	90	70	60	50
1 Cost	0.095	70	50	30	60	40	100
6 Attractive Respondent Interface	0.095	50	70	80	60	60	90
11 Multiple Choice	0.086	100	100	100	100	100	100
2 Question Branching	0.067	100	100	100	100	100	100
3 Touchscreen Compatibility	0.067	80	50	60	50	50	100
5 Easy Survey Creation	0.067	60	80	90	70	80	60
4 Proven In Other Institutions	0.057	50	70	100	60	70	30
13 Pictures	0.048	60	80	80	70	80	100
8 Likert Scales	0.029	100	100	100	100	100	70
12 Comments	0.01	80	80	100	80	80	60
14 Video	0.01	0	0	0	0	0	100
15 Sound	0.01	0	0	0	0	0	100
Percent Compatible		77.51	79.99	84.39	78.27	77.04	86.16

Table 30: Weighted binary matrix scores

Software Evaluation Rubric

	Unsatisfactory – 1	Needs Improvement - 2	Good - 3	Exemplary - 4
Cost	Software is above \$1,500 (10.425 DKK)	Software is between \$1,000 and \$1,500 (10.425 DKK - 6.950 DKK)	Software is between \$500 and \$1,000 (6.950 DKK - 3.475 DKK)	Software is below \$500 (3.475 DKK)
	The price of software is far too high for the features it provides	The price of software is slightly too high for the features it provides	The price of software accurately reflects the features it provides	The price of the software is lower than expected based on the features it provides.
Flexibility	Respondent program cannot be integrated into a kiosk setting	Respondent program may be used in a kiosk setting, but buttons and text are too small to be easily pressed or presented and the respondent may exit the program and access Windows	Respondent program can be easily integrated into a kiosk setting, but either the respondent may exit the program and access Windows or the buttons and text are too small to be easily pressed or presented	Respondent program is specifically tailored for a kiosk setting (buttons easily pressed, no access to Windows, etc)
	It is unclear how this program would be used with surveying; contains no guidelines or suggestions for alternative surveying settings	Few settings can be used in a variety of survey aspects; Includes few suggestions for altering survey for kiosk or web-based surveys	The program is able to provide suggestions for use in web-based and kiosk survey applications	The program features settings for web-base and kiosk surveys as well as many other forms such as e-mail and paper surveys
	No question branching capabilities			Full question branching capabilities
User Support and Instructional Documentation	Program provides little or no help to the survey creator	Program offers limited options for help, such as an external help document	Program offers various forms of help for the survey creator, such as in-program help menus, but may not be quickly accessible	Program offers help to the program creator at any stage
	No tech support available	Program offers online support only	Program provides some ways to reach tech support, such as e-mail and phone	Provides various ways to reach technical support, including phone, e-mail, internet, and fax

	Program does not offer support documentation or outside means of reinforcement	User support documentations are limited	Program provides user with additional websites which relate to support and instructions	Program provides users with additional resources such as web sites, tech support, etc. which are suitable to aid with issues
Company Web Sites	Links do not work properly	Not all links work properly (less than 75%)	Most links work properly (Between 75% and 95%)	All links work properly
	Specific browser needed to view pages, but no directions are available for users to download appropriate browser	Pages work in only one browser, but directions and links are provided so users can download appropriate browser	Most pages work in most browsers	Pages work in most common browsers: Netscape and Internet Explorer
	Multimedia resources do not work	Multimedia resources work some of the time (less than 75% of the time)	Multimedia resources work most of the time (between 75% and 95% of the time)	All multimedia resources work at all times
	Web site is often down or unreliable; software installation often results in aborted efforts or conflicts	Web site is unreliable or software is hard to install properly	Users are able to access web site or install software with minimal effort	Users are able to access web site or install software with ease. Clear and complete directions are available for access or installation
	General Category Subtotal:			

Table 31: General category

Survey Creator	Navigation does not resemble a Windows format with respect to menus, icons, and toolbars	Navigation resembles a Windows format with respect to menus, icons, and toolbars	Navigation is similar to a Windows format with respect to menus, icons, and toolbars	Navigation is consistent with a Windows format with respect to menus, icons, and toolbars
	Does not allow open-ended feedback throughout the survey	150 character limit to be entered in open-ended feedback	250 character limit to be entered in open-ended feedback	Allows open-ended feedback throughout the survey without limitation
	Question and answer fields are created separately			Question and answer fields are created together
	Survey creator is unable to save at regular intervals	Survey creator can save only in special edit screens, but edited material is not always properly saved	Survey creator can save only in special edit screens and edited material is guaranteed to be properly saved	Survey creator can save at any point in survey creation and edited material is guaranteed to be saved
	Does not use a “wizard” approach to guide the creator through adding a question			Uses a “wizard” approach to guide the creator through adding a question
	There is no way to make a survey available in two or more languages	There is a way to make a survey available in two or more languages, but the data from each language’s survey cannot be pooled	There is a way to make a survey available in two or more languages and the data from each language’s survey may be easily pooled	
Question Support	Does not support likert scales	Does not implicitly support likert scales but the user can create their own	Supports likert scales but they are not easy to make	Supports likert scales and is clear as to how to make them
	Does not support open-ended questions	Supports open-ended questions but the field size is too limiting (less than 100 characters allowed) and cannot be adjusted	Supports open-ended questions with a large character allowance (greater than 100 characters) but the survey creator is not in control of field size limitations	Supports open-ended questions and the survey creator controls the field size

	Does not support single choice questions		Supports single choice questions but the “other” choice is not a built-in feature	Supports single choice questions and has a built-in “other” choice available
	Does not support multiple choice question		Supports multiple choice questions but the “other” choice is not a built-in feature	Supports multiple choice questions and has a built-in “other” choice available
Survey Creation Category Subtotal:				

Table 32: Survey creation category

Engaging and Interactive Abilities for Respondent	Does not allow respondents to go back in survey to change responses	Allows respondents to go back, but is not flexible to respondent errors	Respondents have good navigation control but respondent errors may still negatively impact the program	Respondent has full control over question navigation and respondent errors are handled appropriately
	When the respondent finishes the survey, the program exits to Windows	When the respondent finishes the survey, the program must be restarted to take a new respondent	When the respondent finishes the survey, the starting screen can only be reached through a button press	When the respondent finishes the survey, the starting screen will come up either from a time-out or a button press
Graphics and Multimedia for Respondent	Does not support pictures	Pictures are supported, but may not be resized or otherwise manipulated	Pictures are supported and may be resized with some other manipulation options (shading, transition effects)	Full picture support with many manipulation tools.
	Software supplies no multimedia to aid in survey creation	Software supplies some pictures for use in survey creation	Software supplies some pictures as well as other multimedia (video, sounds)	Software supplies an extensive library of pictures and other multimedia
	Text for use in the respondent interface is static			Extensive text feature manipulation possible including custom fonts and multilingual symbols
	The software allows little or no control in changing the colors of the respondent screens	The color of text may be changed	The color of objects such as text, buttons, and the background may be changed	The color of all objects including custom graphics may be changed
Survey Response Category Subtotal:				

Table 33: Survey response category

Data Analysis	Statistical analyzer does not provide graphical result representations	Basic graphical representations are available such as tables	More advanced graphics available such as bar graphs, pie charts, and scatter plots	Advanced graphical data representations are available and may be customized (color, size, 3D effects)
	Program does not allow creation of printable analysis reports	Program allows creation of basic analysis reports limited to text	Program allows graphs and charts from analyzer to be incorporated into reports	Program allows attractive analysis reports incorporating graphs, charts, colored text, and other pictures
	Program does not allow data to be exported to other statistical analyzers	Exporting of data are difficult and inaccurate	Exported data are accurate and formats supported by some other statistical analyzers	Exported data are accurate and formats supported by major statistical analyzers such as Microsoft Access, Excel, SAS and SPSS
	Program does not provide a built-in statistical analysis suite	Program does not provide a built-in statistical analysis suite, and data are stored in text format only	Program does not provide a built-in statistical analysis suite, but the data are formatted for another program to run statistical analysis	Program provides a built-in statistical analysis suite
Survey Analyzer Category Subtotal:				

Table 34: Survey analyzer category

Rubric Definitions

General

Cost

The price of the software package in US dollars

Flexibility

The ability to be used in different platforms, as well as create surveys in a variety of ways.

User Support and Instructional Documentation

The quality of provided written documentation on how to use the software, help provided in the software, as well as outside technical support.

Company Websites

The functionality of the software company's website, including the ability to fully navigate through the pages, all links are active, viewable with a variety of browsers, and the overall reliability of the site.

Survey Creation

Survey Creator

The appearance of the program in creation mode, including similarities to standard Windows program, location of menus and toolbars, and how questions are inserted

Question Support

The type of questions that can be included in a survey

Survey Product

Engaging and Interactive Abilities for Respondent

The ability to have the respondent navigate easily through the survey and errors are handled appropriately, as well as allow for respondent feedback.

Graphics and Multimedia for Respondent

The ability to include pictures, video, and sound during the survey response.

Survey Analyzer

Data Analysis

The ability to compile the collected data, produce graphical representations of the data, and export data into another application.

A3 Survey Questions

Questions for Software Field Testing (all versions)

Why did you come to the National Museum today?

- To see an exhibit
- To take a tour
- To shop in the museum's shop
- To eat in the restaurant
- Other

Have you been to the museum before?

- Yes, this year
- Yes, last year
- Yes, within the last three years
- No

Rate these facilities at the museum

- Service at Information and Ticket Sales
- Service at Museum Shop
- Selection of merchandise at the museum shop
- Service at the Museum Restaurant
- Menu selection at the Museum Restaurant
 - Very good
 - Good
 - Average
 - Poor
 - Very poor
 - Not relevant

Would you visit the National Museum again?

- Yes, I will definitely come again
- Yes, I may come again
- No, I might not come again
- No, I will definitely not come again
- I don't know

Are you a member of the museum club?

- Yes
- No
 - If No, have you heard of the museum club?
 - Yes
 - No

Gender

- Male
- Female

Age

- Under 13
- 13 to 20
- 21 to 30
- 31 to 40
- 41 to 50
- 51 to 60
- 61 to 70
- Over 70

Where do you live?

- If Denmark, what is the postal code?
- If Other, City? Country?

Questions for Independent Setup

Have you taken a computer survey before?

- Yes
- No

How easy was it using the touchscreen (mouse for *SurveyPro*)?

- Very easy
- Easy
- Average
- Difficult
- Very difficult

How do you prefer to be surveyed?

- Computer
- Paper and pen
- Interviewed
- No Preference

How often do you use a computer?

- Daily
- Weekly
- Once in a while
- Never

Questions for Interview Setup

Have you taken a computer survey before?

- Yes
- No

How do you prefer to be surveyed?

- Computer
- Paper and pen
- Interviewed
- No Preference

How often do you use a computer?

- Daily
- Weekly
- Once in a while
- Never

Rate your comfort level during this interview

- Very comfortable
- Comfortable
- Average
- Uncomfortable
- Very uncomfortable

Comments?

Questions for Paper Survey

Have you taken a computer survey before?

- Yes
- No

How do you prefer to be surveyed?

- Computer
- Paper and pen
- Interviewed
- No Preference

How often do you use a computer?

- Daily
- Weekly
- Once in a while
- Never

A4 Answers to Questions

Answers to Questions

All Methods

193 responses to National Museum questions

Q1: What language was the survey taken in?

79% completed the survey in Danish, 21% completed the survey in English.

Q2: What was your main reason for visiting the National Museum today?

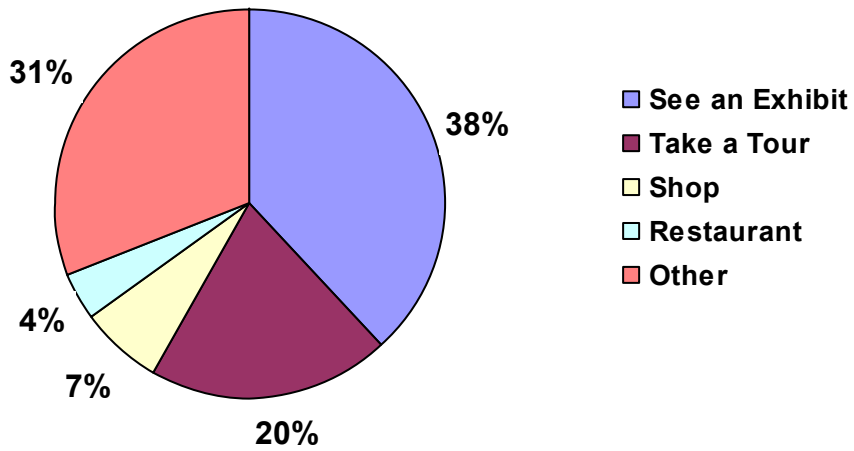


Figure 21: Pie chart of results to Q2

Q3: Have you ever been to the National Museum before?

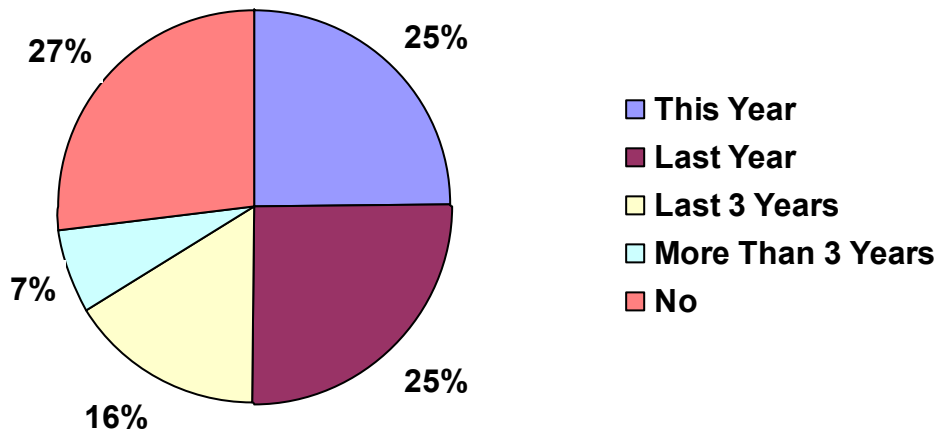


Figure 22: Pie chart of results to Q3

Q4: Have you ever been to the National Museum before?

73% had visited the museum before, 27% had not.

Q5: Rate your satisfaction with the following aspects of the National Museum

	Very Good	Good	Average	Poor	Very Poor	N/A
Ticket & Info Desk	26%	36%	5%	-	-	33%
Museum Shop Service	12%	28%	8%	1%	-	51%
Museum Shop Selection	14%	27%	14%	3%	-	42%
Museum Restaurant Service	3%	16%	10%	2%	2%	67%
Museum Restaurant Selection	3%	9%	12%	7%	1%	68%

Table 35: Results of Q5

Q6: Will you visit the National Museum again?

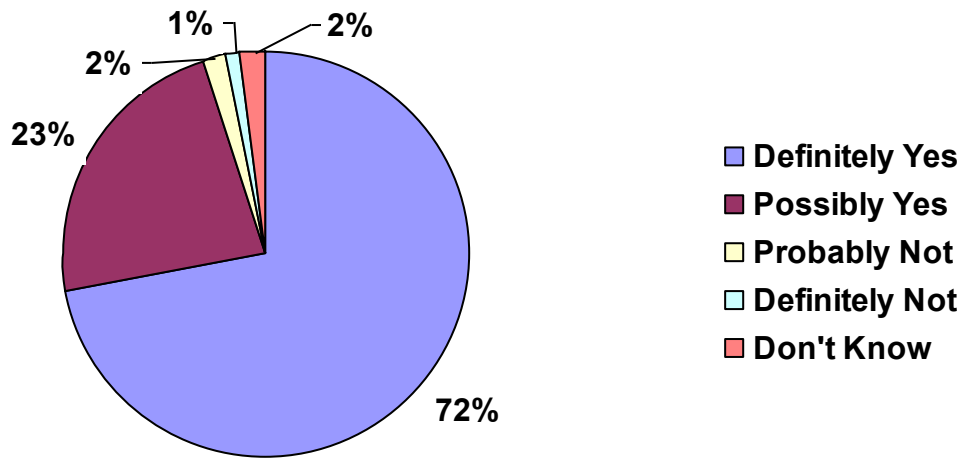


Figure 23: Pie chart of results for Q6

Q7: Are you a member of the museum club?

6% are members, 94% are not.

Q8: Have you ever heard of the museum club?

38% have heard of the club, 62% have not.

Q9: Gender

54% were male, 46% were female.

Q10: Age

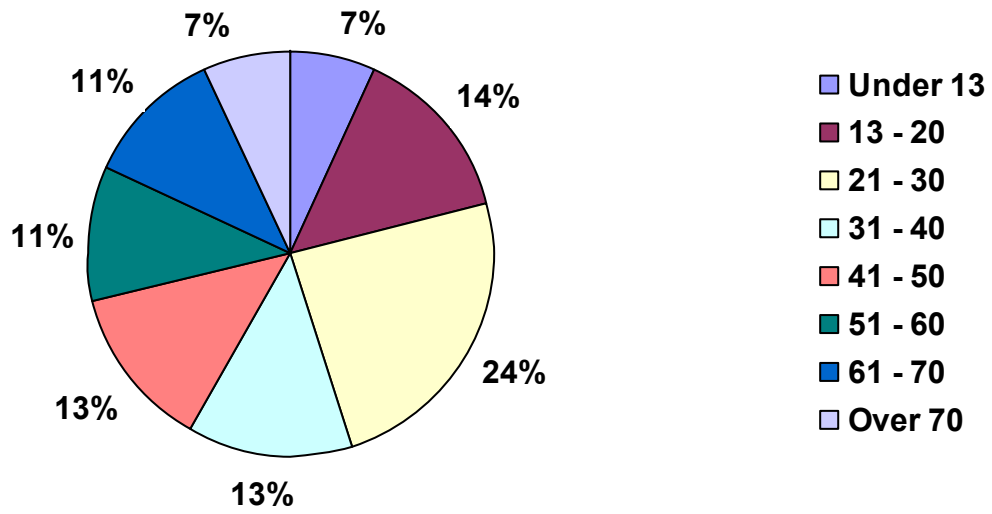


Figure 24: Pie chart of results for Q10

Q11: Do you live in Denmark?

78% live in Denmark, 22% do not.

A5 Interview Reports

Questions to the Interviewer about interviewing process

Analysis of this section will be used in the analysis of the software as well as the methods used in surveying. There are only three interviewers so there isn't significant data to perform any formal statistical analysis. Their opinion and experience with the software and the laptop while interviewing will be referred to in discussions of the software and methods.

1. Rate the following with Extremely Satisfactory, Satisfactory, Neutral, Unsatisfactory, Extremely Unsatisfactory and tell why you chose that level.
 - a. Using the software while interviewing
 - b. Using the laptop while interviewing
2. How often do you use a computer?
Daily, Weekly, Once in a while, Never
3. Have you interviewed visitors before?
Paper or Computer?
4. After using the software, which method would you rather use to interview?
Computer or Paper? Why?
5. After using the laptop, which method would you rather use to interview?
Computer or Paper? Why?
6. Which software would you prefer to interview with? Why?
7. Comments on sampling issues. People in groups, older people?
8. Did you find it limiting to be stationary? Explain.
9. Other comments?

Interview summary with Anne Bashida

This is a summary of the responses made by Anne to the questions for the interviewer in A5. Since Anne only interviewed with one of the software packages, she cannot give a comparison or preference. Anne uses a computer weekly. She has never conducted a paper or computer interview before.

Anne used *Kiosk-in-a-Box* to interview visitors. She said that it was very easy to use and she was satisfied with using that software to conduct interviews. In the same respect she thought it was very easy and satisfying to use a laptop when interviewing. Since she didn't have any experience with paper or computer interviewing before, she gave her opinion on interviewing versus a self-administered survey. On this she says it depends on the questions being asked. For more detail an interview is better. For simple questions with multiple-choice type answers, a self-administered survey is better. With the computer though she noticed that in an interview setting the software was limiting in open-ended conversation aspects of interviewing because there was nowhere to enter the extra information. Anne also felt that having to type and talk was difficult. She noticed that you lose the important eye contact from having to look when typing the open-answer responses.

Sampling wasn't a large issue for Anne. She could get enough people to keep a steady flow of interviews. She did find it challenging to get people in large group to stop and be interviewed since they had to keep up with their group. Older people were more willing to talk to her than younger people. The question that asks the interviewee how comfortable they are was moot since they had already agreed to do the interview. Most people laughed at that question. Anne found it limiting to have to stay near the laptop and felt it was hard to get people to participate in the interview.

Overall, Anne felt that the interview process with the laptop and software was very easy and comfortable. She had no other comments regarding either software or computer issues. She was very pleased to have helped with the project.

Interview summary with Karin Andreassen

Karin Andreassen, the team's liaison, conducted interviews with both software packages. This is a summary of the questions from A5 asked to her about her experience. She uses a computer daily. Interviewing with a computer was a first for her. Her experience has just been with surveying with paper questionnaires by handing out clipboards for the visitors to take, fill out, and return. She understands that interviewing some one introduces a lot of biases but she enjoyed having a dialogue with people regarding their opinions of the museum. Most, in her opinion, wouldn't have taken a survey themselves but enjoy the interview situation. Karin felt her attitude made them relax and enjoy answering the questions. The people had lots to say once they knew some one was listening. The situation was personal. The individual attention was pleasing to most people.

With respect to using the software, Karin thought both were satisfactory, but she liked *SurveyPro* better. This opinion is based on the fact that *SurveyPro* has a "Comments" option built into every page, so at anytime the interviewer could enter comments. The ability to navigate forward and backward in the question list, which was in both software surveys, was also a useful feature because it gave her freedom to go back to another question to add comments. The small click boxes in *SurveyPro* were tricky at first but she got used to them.

With respect to the laptop, she was extremely satisfied. There was no problem with talking and typing. She didn't feel limited by its stationary position. The location was good enough that she could get people who looked as though they were heading out of the museum or looked like they were wandering around having been there a while.

Since Karin hasn't had any interviewing experience with paper or computers before this, she had nothing to compare with her interviewing experience. Overall, Karin was pleased with the interviewing experience. She had no problems with getting people to take the survey. She had no other comments about the interviews with the software packages and laptop.

Interview summary with Kitt Boding

Kitt Boding was the third interviewer to test the software. She interviewed with both programs. The following is a summary of her responses to the questions for the interviewer found in A5. Kitt has interviewing experience but only with a tape recorder in her studies for school. When asked to compare the two experiences, computer and tape recorder interviewing, she said that they are too different to compare. However, even though the tape recorder gets exactly what the interviewee is saying, it takes a long time to compile the information later and a different interpretation may be made when listening to the conversation again.

Kitt had a different opinion for each software package. Her satisfaction in interviewing with *Kiosk-in-a-Box* was neutral. She found the program annoying. There was no place to type in comments when the respondents kept talking about things related to the questions they were asked. They would rarely just answer the question. However, *SurveyPro* was extremely satisfying. Although she could not determine exactly why, she felt the graphics were better. The comment button was extremely useful on each page. She thought it was easier to go to the next question. Having the last question on the survey to be a general comments page was good for the respondent since the questions didn't cover as many opinion questions on their visit as they thought it would. After interviewing with both software packages, she feels that *SurveyPro* is a better program to use because of the comments button, clear format, and graphics.

Using the laptop to interview was extremely satisfying for Kitt. She uses a computer daily and had no problems typing and talking at the same time. However she found the interviewees were a little uncomfortable with the situation. They were curious and wanted to see what she was typing. They felt she was hiding behind the computer. However, she found that typing the answers was much faster than writing because you can fix errors faster as well as add things that you missed after the interview, and it is already in the computer for later. After using the computer and software, she still feels that interviewing that way is much more effective than by paper.

Getting people to take the survey was no problem from her perspective. The people just entering the museum didn't understand what they could offer in an interview since they hadn't seen the museum yet. Older people would mention that they

don't know how to use a computer when they saw it sitting there. Kitt didn't find it limiting to be stationary. She thought the location was good because it was visible to the exiting people but not the entering people. It was out of the way from the crowds that form at the information and ticket booth.

Overall, she thought that the interviews went well. In her opinion, the interviews and self-administered surveys should be mixed-up. Leave the self-administered one up and now and then conduct interviews. With respect to the self-administered survey, Kitt felt that younger people would be less honest in the computer survey just wanting to play around with the computer, and the older people won't take the computer survey because they aren't comfortable using a computer.

A6 Software Training

Tutorial Sessions

Two tutorial sessions were held with Karin Andreassen to familiarize her with *Kiosk-in-a-Box* and *SurveyPro* so that she could help in our recommendation of the most appropriate software for use in the museum. In these sessions, we showed her how to create a questionnaire, insert various types of questions and objects, and use the statistical analyzer.

We first showed Karin how to create and begin working on a survey using *Kiosk-in-a-Box*. Immediately, she found the process of creating a new survey confusing, as it required several steps through multiple levels of tabs in the editor window. We then showed her the process of inserting text and buttons, as well as the formatting of each. She found this difficult as to the number of steps required to format text and buttons. She did not feel it was easy enough to do a simple task such as format text. We then showed Karin how to add a new screen and link questions together. She understood the concept of buttons and linking well, but found it inconvenient if a new question was to be added somewhere in the middle of the survey. Three types of questions were reviewed: single choice, multiple choice, and open-ended. Karin found it difficult to format screens to store questions as a specific type. Again, this stems from the fact that it requires navigation through many layers of tabs. Overall, Karin found the creation of a survey using *Kiosk-in-a-Box* counterintuitive and confusing.

Also within the first tutorial session, we showed Karin how to begin creating a survey using *SurveyPro*. She was pleased to see that the software could be used to create and analyze paper surveys in addition to computer surveys. We then showed her how to use *SurveyPro*'s wizard to insert various types of questions. We showed her how to insert single choice, multiple choice, question groups, unlimited open-ended and input controlled open-ended questions. We also showed her how to insert text and graphics. She was amazed to see how easy it was to insert a question and create a response scale. Karin was also pleased with the formatting capabilities of the software such as colors, text size, and overall appearance.

In the next tutorial session, we first showed Karin the data storage and analysis capabilities of *Kiosk-in-a-Box*. She was familiar with the tabular format of the *Excel* sheet that held the respondent data. She was also familiar with adding new worksheets, sorting data, cutting and pasting, and creating graphs. She was comfortable with manipulating the data in *Excel*, but found it very time consuming and monotonous. She conceded that *Access* and *Excel* provide powerful analysis capabilities, but they do not aid in data analysis to the extent she desires.

We then showed Karin the statistical analyzer and some of the possibilities of *SurveyPro*. Using the survey we already created and collected data for, we first showed her the executive summary that is produced instantly which displays the breakdown of all the answers to the question. This summary is, in essence, the same report she had produced with *Excel* in past paper surveys, which took her much time. We then showed her how to create simple charts, graphs, and cross-tabbed questions. She was amazed at how easy it was to create very useful displays of the desired information. We then briefly showed her how to perform confidence intervals and chi-squared analyses on compared questions. She was amazed at how easy the correlations could be accomplished.

In summary, Karin appeared to be very happy with *SurveyPro*. She found creating a survey very easy. She also was impressed by the ease and power of the statistical analyzer. In contrast, Karin was not impressed with *Kiosk-in-a-box*. She found the survey creator confusing and the statistical analysis capabilities lacking. Overall, we believe Karin would be very happy using *SurveyPro 3.0* in the National Museum.

A7 Analysis Plan

Questions to Compare (Software)

Analysis in this section will be done using a Chi-square test for significant differences in data sets taking into account the survey software and method it was used in. These tests give comparisons between the two software packages.

1.1 HYPOTHESIS: There should be no differences in the responses made to each software package in the independent or interview methods

Have you taken a computer survey before? Yes, No

Hypothesis 1: Software vs. Computer survey experience			
	SurveyPro	Kiosk-in-a-Box	Total
Yes	12	11	23
No	14	17	31
Total	26	28	54

Table 36: Results of software versus computer experience

>>Degrees of freedom (df) = (rows - 1) x (columns - 1)

>> df = (2-1) x (2-1) = 1

>>Calculating expected frequencies for each cell ...

>>Processing row 1, column 1 ...

>> Observed value (O) = 12

>> Expected value (E) = (row total x column total) / grand total

>> E = (23 x 26) / 54 = 11.0740740740741

>> Chi-square = (O - E)squared / E

>> Chi-square = ((12 - 11.0740740740741) **2) / 11.0740740740741

>> Chi-square = 0.0774185556794252

>>Total chi-square now = 0.0774185556794252

>>Processing row 1, column 2 ...

>> Observed value (O) = 11

>> Expected value (E) = (row total x column total) / grand total

>> E = (23 x 28) / 54 = 11.9259259259259

>> Chi-square = (O - E)squared / E

```

>>          Chi-square = ((11 - 11.9259259259259) **2) / 11.9259259259259
>>          Chi-square = 0.0718886588451805
>>Total chi-square now = 0.149307214524606

```

```

>>Processing row 2, column 1 ...

```

```

>>      Observed value (O) = 14
>>      Expected value (E) = (row total x column total) / grand total
>>          E = (31 x 26) / 54 = 14.9259259259259
>>          Chi-square = (O - E)squared / E
>>          Chi-square = ((14 - 14.9259259259259) **2) / 14.9259259259259
>>          Chi-square = 0.0574395735686058
>>Total chi-square now = 0.206746788093212

```

```

>>Processing row 2, column 2 ...

```

```

>>      Observed value (O) = 17
>>      Expected value (E) = (row total x column total) / grand total
>>          E = (31 x 28) / 54 = 16.0740740740741
>>          Chi-square = (O - E)squared / E
>>          Chi-square = ((17 - 16.0740740740741) **2) / 16.0740740740741
>>          Chi-square = 0.0533367468851342
>>Total chi-square now = 0.260083534978346

```

```

>>Calculating probability (P) ...

```

```

>>Looking up critical values for chi at df = 1:

```

```

>>      Sig levels:0.20 0.10 0.05 0.025 0.01 0.001

```

```

>>      Crit vals:  1.64 2.71 3.84 5.02 6.64 10.83

```

Degrees of freedom: 1

Chi-square = 0.26

For significance at the .05 level, chi-square should be greater than or equal to 3.84.

The distribution is not significant.

p is less than or equal to 1.

How do you prefer to be surveyed? Computer, Paper and pen, Interviewed, No Preference

Hypothesis 1: Software vs. Survey preference			
	SurveyPro	Kiosk-in-a-Box	Total
Computer	18	14	32
Paper	2	4	6
Interview	0	2	2
No preference	6	8	14
Total	26	28	54

Table 37: Results of software versus survey preference

Degrees of freedom: 3

Chi-square = 3.38

For significance at the .05 level, chi-square should be greater than or equal to 7.82.

The distribution is not significant.

p is less than or equal to 1

How often do you use a computer? Daily, Weekly, Once in a while, Never

Hypothesis 1: Software vs. Computer experience			
	SurveyPro	Kiosk-in-a-Box	Total
Daily	21	20	41
Weekly	4	5	9
Once in a while	1	2	3
Never	0	1	1
Total	26	28	54

Table 38: Results of software versus computer experience

Degrees of freedom: 3

Chi-square = 1.40

For significance at the .05 level, chi-square should be greater than or equal to 7.82.

The distribution is not significant.

p is less than or equal to 1.

1.2 HYPOTHESIS: There is no difference in the time it takes to complete the independent survey with the different survey packages.

Time to complete survey (independent method)

Anova: Single Factor

SUMMARY

<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>	<i>Standard Error</i>
SurveyPro 3.0	26	22:00	2:41	0:01	0:08
Kiosk-in-a-Box	28	15:06	3:06	0:01	0:08

ANOVA

<i>Source of Variation</i>	<i>SS</i>	<i>Df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	0.0041	1	0.0041	4.70	0.035	4.03
Within Groups	0.0454	52	0.0009			
Total	0.0495	53				

Table 39: ANOVA for time versus software for independent method

1.3 HYPOTHESIS: There is no difference in the time it takes to complete the interview survey with the different survey packages.

Time to complete survey (interview method)

Anova: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance	Standard Error
SurveyPro 3.0	66	10:47	3:04	0:03	0:08
Kiosk-in-a-Box	53	4:24	4:09	0:04	0:11

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	0.0602	1	0.0602	21.42	0.00001	3.92
Within Groups	0.3288	117	0.0028			
Total	0.3890	118				

Table 40: ANOVA for time versus software for interview method

Questions to Compare (Hardware)

Analysis in this section is to be done using the Chi-square test for significant differences. These tests give comparisons regarding the use of a touchscreen in independent surveying. This will aid in the recommendations for hardware for the museum.

2.1 HYPOTHESIS: There is no difference in the ease of use of the touchscreen with or without past computer survey experience.

With this comparison it can be found whether there is a correlation between a person's experience with computer surveys and their comfort level using the touchscreen. Such questions that could be answered are: If a person has experience with computer surveys, do they find the touchscreen easier to use than some one who has no past experience with computer surveys? Is there a correlation between finding the touchscreen easy to use and having past computer survey experience?

Independent Method (*Kiosk-in-a-Box* only)

- Have you taken a computer survey before? Yes, No
- How easy was it using the touchscreen? Very easy, Easy, Average, Difficult, Very difficult

Hypothesis 1: Touchscreen use vs. Computer survey experience						
	Very easy	Easy	Average	Difficult	Very Difficult	Total
Yes	5	2	4	0	0	11
No	6	8	1	1	1	17
Total	11	10	5	1	1	28

Table 41: Results of touchscreen use versus computer survey experience

Degrees of freedom: 4

Chi-square = 6.50

For significance at the .05 level, chi-square should be greater than or equal to 9.49.

The distribution is not significant.

p is less than or equal to 0.20.

2.1 Hypothesis: There is no difference in the ease of use of the touchscreen with varying levels of computer experience.

With this comparison, it can be found whether there is a correlation between a person's past experience with computers and how easy they found using the touchscreen. A question that could be answered is: Does experience and familiarity with computers aid in using a touchscreen?

Independent Method (*Kiosk-in-a-Box* only)

- How easy was it using the touchscreen? Very easy, Easy, Average, Difficult, Very difficult
- How often do you use a computer? Daily, Weekly, Once in a while, Never

Hypothesis 2: Ease of touchscreen use vs. Computer experience						
	Very easy	Easy	Average	Difficult	Very Difficult	Total
Daily	8	8	4	0	0	20
Weekly	3	0	1	0	1	5
Once in a while	0	2	0	0	0	2
Never	0	0	0	1	0	1
Total	11	10	5	1	1	28

Table 42: Results of ease of touchscreen and computer experience

Degrees of freedom: 12

Chi-square = 38.49

p is less than or equal to 0.001.

The distribution is significant.

2.3 Hypothesis: There is no difference in a person’s preference for being surveyed with varying ease of use of the touchscreen.

With this comparison, it can be found whether there is a correlation between a person’s preference of being surveyed and their experience with the touchscreen. A question that could be answered is: Did a person’s comfort with the touchscreen affect how they prefer to be surveyed?

Independent Method (*Kiosk-in-a-Box* only)

- How easy was it using the touchscreen? very easy, easy, average, difficult, very difficult
- How do you prefer to be surveyed? Computer, Paper and pen, Interviewed, No Preference

Hypothesis 3: Ease of touchscreen use vs. Survey preference						
	Very easy	Easy	Average	Difficult	Very Difficult	Total
Computer	6	5	3	0	0	14
Paper	0	2	1	0	1	4
Interview	1	1	0	0	0	2
No preference	4	2	1	1	0	8
Total	11	10	5	1	1	28

Table 43: Results of ease of touchscreen versus survey preference

Degrees of freedom: 12

Chi-square = 11.71

For significance at the .05 level, chi-square should be greater than or equal to 21.03.

The distribution is not significant.

p is less than or equal to 1.

2.4 HYPOTHESIS: There is no difference in the time it took to complete the surveys with varying ease of use of the touchscreen.

With this comparison, it can be found whether there is a correlation between ease of use of the touchscreen and the time to take the survey. A question that could be answered is: Does a person’s skill and comfort with the touchscreen affect the time to complete the survey?

Independent Method (*Kiosk-in-a-Box* only)

- Time to complete survey
- How easy was it using the touchscreen? Very easy, Easy, Average, Difficult, Very difficult

Anova: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance	Standard Error
Very easy	11	6:45	2:47	0:00	0:10
Easy	10	7:52	3:11	0:01	0:14
Neutral	5	15:44	3:08	0:00	0:15
Difficult	1	4:15	4:15	#DIV/0!	#DIV/0!
Very Difficult	1	4:30	4:30	#DIV/0!	#DIV/0!

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	0.0076	4	0.0019	2.54	0.07	2.80
Within Groups	0.0172	23	0.0007			
Total	0.0248	27				

Table 44: ANOVA of time versus ease of touchscreen use

2.5 HYPOTHESIS: There is no difference in ease of use of the touchscreen with whether or not they used the touchscreen or keyboard for typing.

With this comparison, it can be found whether there is a correlation between a person's choice of using the keyboard or the touchscreen during the survey and their ease of use of the touch screen. A question that could be answered is: did a person's choice to use the touchscreen affect their decision on the ease of use of the touchscreen? Did a person's choice to use the keyboard affect their decision on the ease of use of the touchscreen?

Independent Method (*Kiosk-in-a-Box* only)

- Using Keyboard or Touchscreen
- How easy was it using the touchscreen? Very easy, Easy, Average, Difficult, Very difficult

Hypothesis 5: Touchscreen use vs. Ease of touchscreen use						
	Very easy	Easy	Average	Difficult	Very Difficult	Total
Keyboard	7	2	3	1	1	14
Touchscreen	4	8	2	0	0	14
Total	11	10	5	1	1	28

Table 45: Results of touchscreen use versus ease of touchscreen

Degrees of freedom: 4

Chi-square = 6.62

For significance at the .05 level, chi-square should be greater than or equal to 9.49.

The distribution is not significant.

p is less than or equal to 0.20.

2.6 HYPOTHESIS: There is no difference in whether the person used the touchscreen or keyboard with varying levels of computer experience.

With this comparison, it can be found whether there is a correlation between the uses of the keyboard or touchscreen during the survey and how often the visitor uses a computer. A question that could be answered is: Did a person's past computer use affect their preference for using the keyboard or touchscreen during the survey?

Independent Method (*Kiosk-in-a-Box* only)

- Using Keyboard or Touchscreen
- How often do you use a computer? Daily, Weekly, Once in a while, Never

Hypothesis 6: Touchscreen use vs. Computer experience					
	Daily	Weekly	Once in a while	Never	Total
Keyboard	10	3	0	1	14
Touchscreen	10	2	2	0	14
Total	20	5	2	1	28

Table 46: Results of touchscreen use versus computer experience

Degrees of freedom: 3

Chi-square = 3.2

For significance at the .05 level, chi-square should be greater than or equal to 7.82.

The distribution is not significant.

p is less than or equal to 1.

2.7 HYPOTHESIS: There is no difference in whether or not a person used the touchscreen or keyboard with any particular age.

With this comparison, it can be found whether there is a correlation between the uses of the keyboard or touchscreen and the age of the respondent. A question that could be answered is: Does a person's age affect whether they used the keyboard or touchscreen?

Independent Method (*Kiosk-in-a-Box* only)

- Using Keyboard or Touchscreen
- Age

Hypothesis 7: Age vs. Touchscreen use									
	Under 13	13 to 20	21 to 30	31 to 40	41 to 50	51 to 60	61 to 70	Over 70	Total
Keyboard	0	1	4	3	4	1	0	1	14
Touchscreen	3	3	2	0	3	1	2	0	14
Total	3	4	6	3	7	2	2	1	28

Table 47: Results of age versus touchscreen use

Degrees of freedom: 7

Chi-square = 10.81

For significance at the .05 level, chi-square should be greater than or equal to 14.07.

The distribution is not significant.

p is less than or equal to 0.20.

2.8 HYPOTHESIS: There is no difference in ease of use of the touchscreen with any particular age.

With this comparison, it can be found whether there is a correlation between the age of the respondent and how easy the respondent found the touchscreen. A question that could be answered is: Is a touchscreen easier or harder for a person of a particular age?

Independent Method (*Kiosk-in-a-Box* only)

- Age
- How easy was it using the touchscreen? Very easy, Easy, Average, Difficult, Very difficult

Hypothesis 8: Age vs. Ease of touchscreen use

	Under 13	13 to 20	21 to 30	31 to 40	41 to 50	51 to 60	61 to 70	Over 70	Total
Very easy	0	2	3	1	4	0	1	0	11
Easy	2	1	2	0	2	2	1	0	10
Average	1	1	0	2	1	0	0	0	5
Difficult	0	0	0	0	0	0	0	1	1
Very Difficult	0	0	1	0	0	0	0	0	1
Total	3	4	6	3	7	2	2	1	28

Table 48: Results of age versus ease of touchscreen

Degrees of freedom: 28

Chi-square = 45.40

p is less than or equal to 0.025.

The distribution is significant.

Questions to Compare (Methods)

Analysis will be done in *Excel* for all of these comparisons. A form of Chi-square testing is to be used to evaluate if there is a significant difference in the data sets. For the tests with multiple methods to be evaluated, a test of significance will also be conducted between methods as well as between questions. There should be no significant difference in the responses to the methods unless otherwise noted in the hypotheses. These tests give comparisons between each method: Independent, Interview, and Paper. Where time is used in the analysis, an ANOVA test will be performed, since time is a continuous variable with an expected normal distribution.

3.1 HYPOTHESIS: There is no difference in the time it takes to complete the surveys between each survey method.

Independent Method (*Kiosk-in-a-Box* and *Survey Pro 3.0* data separate)

Interview Method (*Kiosk-in-a-Box* and *Survey Pro 3.0* data separate)

Paper Method

Anova: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance	Standard Error
Independent: Kiosk-in-a-Box	28	15:06	3:06	0:01	0:08
Independent: SurveyPro	26	22:00	2:41	0:01	0:08
Interview: SurveyPro	66	10:47	3:04	0:03	0:08

Interview: Kiosk- in-a-Box	53	4:24	4:09	0:04	0:11
Paper	11	23:18	2:07	0:02	0:19

ANOVA

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	0.1187	4	0.0297	13.46	0.00001	2.422126
Within Groups	0.3948	179	0.0022			
Total	0.5135	183				

Table 49: ANOVA for time versus survey method

Anova: Single Factor

SUMMARY

<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>	<i>Standard Error</i>
Independent: SurveyPro	26	22:00	2:41	0:01	0:08
Interview: SurveyPro	66	10:47	3:04	0:03	0:08

ANOVA

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	0.0047	1	0.0047	2.32	0.13	3.95
Within Groups	0.1818	90	0.0020			
Total	0.1864	91				

Table 50: ANOVA results for analysis with *SurveyPro* between methods

Anova: Single Factor

SUMMARY

<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>	<i>Standard Error</i>
Interview: Kiosk-in-a- Box	53	4:24	4:09	0:04	0:11
Independent: Kiosk- in-a-Box	28	15:06	3:06	0:01	0:08

ANOVA

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	0.0350	1	0.0350	14.33	0.0003	3.96
Within Groups	0.1925	79	0.0024			
Total	0.2274	80				

Table 51: ANOVA results of the analysis with *Kiosk-in-a-Box* between methods

3.2 HYPOTHESIS: There is no difference in the average age surveyed using each method.

Independent Method (Kiosk-in-a-Box and Survey Pro 3.0 data together)
Interview Method (Kiosk-in-a-Box and Survey Pro 3.0 data together)
Paper Method

Hypothesis 2: Age vs. Survey method used									
	Under 13	13 to 20	21 to 30	31 to 40	41 to 50	51 to 60	61 to 70	Over 70	Total
Independent	3	5	14	11	10	6	4	1	54
Interview	8	22	25	12	14	14	14	10	119
Paper	2	1	7	3	2	1	3	1	20
Total	13	28	46	26	26	21	21	12	193

Table 52: Results of age versus survey method

Degrees of freedom: 14

Chi-square = 14.29

For significance at the .05 level, chi-square should be greater than or equal to 23.68.

The distribution is not significant.

p is less than or equal to 1.

3.3 HYPOTHESIS: There is no difference in a person's computer survey experience between survey methods.

- Have you taken a computer survey before? Yes, No

Independent Method (Kiosk-in-a-Box and Survey Pro 3.0 data together)
Interview Method (Kiosk-in-a-Box and Survey Pro 3.0 data together)
Paper Method

Hypothesis 3: Survey method vs. Computer survey experience			
	Yes	No	Total
Independent	23	31	54
Interview	49	70	119
Paper	5	15	20
Total	77	116	193

Table 53: Results of survey method versus computer survey experience

Degrees of freedom: 2

Chi-square = 2.10

For significance at the .05 level, chi-square should be greater than or equal to 5.99.

The distribution is not significant.

p is less than or equal to 1.

3.4 HYPOTHESIS: There is no difference in a person’s preference between survey methods.

- How do you prefer to be surveyed? Computer, Paper and pen, Interviewed, No Preference

Independent Method (Kiosk-in-a-Box and Survey Pro 3.0 data together)

Interview Method (Kiosk-in-a-Box and Survey Pro 3.0 data together)

Paper Method

Hypothesis 4: Survey preference vs. Survey method used					
	Computer	Paper	Interview	No preference	Total
Independent	32	6	2	14	54
Interview	18	5	56	40	119
Paper	2	12	1	5	20
Total	52	23	59	59	193

Table 54: Results of survey preference versus survey method used

Degrees of freedom: 6

Chi-square = 102.56

p is less than or equal to 0.001.

The distribution is significant.

3.5 HYPOTHESIS: There is no difference in a person’s computer experience between survey methods.

- How often do you use a computer? Daily, Weekly, Once in a while, Never

Independent Method (Kiosk-in-a-Box and Survey Pro 3.0 data together)

Interview Method (Kiosk-in-a-Box and Survey Pro 3.0 data together)

Paper Method

Hypothesis 5: Survey method vs. Computer experience					
	Daily	Weekly	Once in a while	Never	Total
Independent	41	9	3	1	54
Interview	83	20	7	9	119
Paper	10	2	6	2	20
Total	134	31	16	12	193

Table 55: Results of survey method versus computer experience

Degrees of freedom: 6

Chi-square = 17.08

p is less than or equal to 0.01.

The distribution is significant.

3.6 HYPOTHESIS: Whether or not a person has taken a computer survey before makes no difference in a person's preference in being surveyed.

With this comparison, it can be found whether there is a correlation between a person's experience with computer surveys and their preference for being surveyed. Such questions that could be answered are: Does past experience with computer surveys affect a person's preference with regards to survey techniques? With past experience in computer surveying does a person still prefer to be surveyed by computer?

Independent Method (*Kiosk-in-a-Box* and *Survey Pro 3.0* data together)

- Have you taken a computer survey before? Yes, No
- How do you prefer to be surveyed? Computer, Paper and pen, Interviewed, No Preference

Hypothesis 6: Computer survey experience vs. Survey preference					
	Computer	Paper	Interview	No preference	Total
Yes	17	1	2	3	23
No	15	5	0	11	31
Total	32	6	2	14	54

Table 56: Results of computer survey experience versus survey preference for independent method

Degrees of freedom: 3

Chi-square = 8.363

p is less than or equal to 0.05.

The distribution is significant

Interview Method (*Kiosk-in-a-Box* and *Survey Pro 3.0* data together)

- Have you taken a computer survey before? Yes, No
- How do you prefer to be surveyed? Computer, Paper and pen, Interviewed, No Preference

Hypothesis 6: Computer survey experience vs. Survey preference					
	Computer	Paper	Interview	No preference	Total
Yes	10	3	19	17	49
No	8	2	37	23	70
Total	18	5	56	40	119

Table 57: Results of computer survey experience versus survey preference for interview method

Degrees of freedom: 3

Chi-square = 3.51

For significance at the .05 level, chi-square should be greater than or equal to 7.82.

The distribution is not significant.

p is less than or equal to 1.

Paper Method

- Have you taken a computer survey before? Yes, No
- How do you prefer to be surveyed? Computer, Paper and pen, Interviewed, No Preference

Hypothesis 6: Computer survey experience vs. Survey preference					
	Computer	Paper	Interview	No preference	Total
Yes	1	2	0	2	5
No	1	10	1	3	15
Total	2	12	1	5	20

Table 58: Results of computer survey experience versus survey preference for paper method

Degrees of freedom: 3

Chi-square = 2.04

For significance at the .05 level, chi-square should be greater than or equal to 7.82.

The distribution is not significant.

p is less than or equal to 1

3.7 HYPOTHESIS: There is no difference in a person's preference for being surveyed

with varying levels of computer experience.

With this comparison, it can be found whether there is a correlation between a person's past experience with computers and which method of surveying is preferred. A question that could be answered is: Does experience and familiarity with computers affect a person's preference with regards to survey methods?

Independent Method (*Kiosk-in-a-Box* and *Survey Pro 3.0* data together)

- How do you prefer to be surveyed? Computer, Paper and pen, Interviewed, No Preference
- How often do you use a computer? Daily, Weekly, Once in a while, Never

Hypothesis 7: Survey Preference vs. Computer Experience					
	Computer	Paper	Interview	No preference	Total
Daily	28	2	2	9	41
Weekly	3	2	0	4	9
Once in a while	1	2	0	0	3
Never	0	0	0	1	1
Total	32	6	2	14	54

Table 59: Results of survey preference versus computer experience for independent method

Degrees of freedom: 9

Chi-square = 18.36

p is less than or equal to 0.05.

The distribution is significant.

Interview Method (*Kiosk-in-a-Box* and *Survey Pro 3.0* data together)

- How do you prefer to be surveyed? Computer, Paper and pen, Interviewed, No Preference
- How often do you use a computer? Daily, Weekly, Once in a while, Never

Hypothesis 7: Survey preference vs. Computer experience					
	Computer	Paper	Interview	No preference	Total

Daily	14	3	39	27	83
Weekly	3	1	9	7	20
Once in a while	1	0	3	3	7
Never	0	1	5	3	9
Total	18	5	56	40	119

Table 60: Results of survey preference versus computer experience for interview method

Degrees of freedom: 9

Chi-square = 3.35

For significance at the .05 level, chi-square should be greater than or equal to 16.92.

The distribution is not significant.

p is less than or equal to 1.

Paper Method

- How do you prefer to be surveyed? Computer, Paper and pen, Interviewed, No Preference
- How often do you use a computer? Daily, Weekly, Once in a while, Never

Hypothesis 7: Survey preference vs. Computer experience					
	Computer	Paper	Interview	No preference	Total
Daily	1	5	0	4	10
Weekly	1	0	1	0	2
Once in a while	0	6	0	0	6
Never	0	1	0	1	2
Total	2	12	1	5	20

Table 61: Results of survey preference vs computer experience for paper method

Degrees of freedom: 9

Chi-square = 19.4

p is less than or equal to 0.025.

The distribution is significant.

3.8 HYPOTHESIS: There is no difference in a person's preference for being surveyed with varying age.

With this comparison, it can be found whether there is a correlation between a person's age and their preference for being surveyed. Such questions that could be answered are: Does a person's age affect their preference for being surveyed? Is there an age bias in any of the methods?

Independent Method (*Kiosk-in-a-Box* and *Survey Pro 3.0* data together)

- Age

- How do you prefer to be surveyed? Computer, Paper and pen, Interviewed, No Preference

Hypothesis 8: Age vs. Survey preference									
	Under 13	13 to 20	21 to 30	31 to 40	41 to 50	51 to 60	61 to 70	Over 70	Total
Computer	3	3	20	5	7	3	1	0	42
Paper	0	0	2	0	1	2	1	0	6
Interview	0	0	1	0	1	0	0	0	2
No preference	0	2	1	6	1	1	2	1	14
Total	3	5	24	11	10	6	4	1	64

Table 62: Results of age versus survey performance for independent method

Degrees of freedom: 21

Chi-square = 28.63

For significance at the .05 level, chi-square should be greater than or equal to 32.67.

The distribution is not significant.

p is less than or equal to 0.20.

Interview Method (*Kiosk-in-a-Box* and *Survey Pro 3.0* data together)

- Age
- How do you prefer to be surveyed? Computer, Paper and pen, Interviewed, No Preference

Hypothesis 8: Age vs. Survey preference									
	Under 13	13 to 20	21 to 30	31 to 40	41 to 50	51 to 60	61 to 70	Over 70	Total
Computer	0	3	7	4	1	0	3	0	18
Paper	1	1	1	0	0	1	1	0	5
Interview	4	7	13	5	5	9	5	8	56
No preference	3	11	4	3	8	4	5	2	40
Total	8	22	25	12	14	14	14	10	119

Table 63: Results of age versus survey performance for interview method

Degrees of freedom: 21

Chi-square = 27.21

For significance at the .05 level, chi-square should be greater than or equal to 32.67.

The distribution is not significant.

p is less than or equal to 0.20.

Paper Method

- Age
- How do you prefer to be surveyed? Computer, Paper and pen, Interviewed, No Preference

Hypothesis 8: Age vs. Survey preference									
	Under 13	13 to 20	21 to 30	31 to 40	41 to 50	51 to 60	61 to 70	Over 70	Total
Computer	1	0	0	1	0	0	0	0	2
Paper	1	1	5	0	1	1	2	1	12
Interview	0	0	0	1	0	0	0	0	1
No preference	0	0	2	1	1	0	1	0	5
Total	2	1	7	3	2	1	3	1	20

Table 64: Results of age versus survey performance for paper method

Degrees of freedom: 21

Chi-square = 16.79

For significance at the .05 level, chi-square should be greater than or equal to 32.67.

The distribution is not significant.

p is less than or equal to 1.

3.9 HYPOTHESIS: There is no difference in computer experience with varying age.

With this comparison, it can be found whether there is a correlation between a person's age and how often they use a computer. A question that could be answered is: Is age a factor in the amount of computer use a person has?

Independent Method (*Kiosk-in-a-Box* and *Survey Pro 3.0* data together)

- Age
- How often do you use a computer? Daily, Weekly, Once in a while, Never

Hypothesis 9: Age vs. Computer experience									
	Under 13	13 to 20	21 to 30	31 to 40	41 to 50	51 to 60	61 to 70	Over 70	Total
Daily	1	3	12	9	6	7	3	0	41
Weekly	1	2	2	2	1	1	0	0	9
Once in a while	1	0	0	0	0	1	1	0	3
Never	0	0	0	0	0	0	0	1	1
Total	3	5	14	11	7	9	4	1	54

Table 65: Results of age versus computer experience for independent method

Degrees of freedom: 21

Chi-square = 67.68

p is less than or equal to 0.001.

The distribution is significant.

Interview Method (*Kiosk-in-a-Box* and *Survey Pro 3.0* data together)

- Age
- How often do you use a computer? Daily, Weekly, Once in a while, Never

Hypothesis 9: Age vs. Computer experience									
	Under 13	13 to 20	21 to 30	31 to 40	41 to 50	51 to 60	61 to 70	Over 70	Total
Daily	4	15	20	8	9	8	10	9	83
Weekly	2	3	3	4	4	2	1	1	20
Once in a while	1	1	1	0	1	2	2	0	8
Never	1	3	1	0	0	2	2	0	9
Total	8	22	25	12	14	14	15	10	120

Table 66: Results of age versus computer experience for interview method

Degrees of freedom: 21

Chi-square = 17.56

For significance at the .05 level, chi-square should be greater than or equal to 32.67.

The distribution is not significant.
 ρ is less than or equal to 1.

Paper Method

- Age
- How often do you use a computer? Daily, Weekly, Once in a while, Never

Hypothesis 9: Age vs. Computer experience									
	Under 13	13 to 20	21 to 30	31 to 40	41 to 50	51 to 60	61 to 70	Over 70	Total
Daily	0	1	5	2	2	0	0	0	10
Weekly	1	0	0	1	0	0	0	0	2
Once in a while	1	0	2	0	0	1	2	0	6
Never	0	0	0	0	0	0	1	1	2
Total	2	1	7	3	2	1	3	1	20

Table 67: Results of age versus computer experience for paper method

Degrees of freedom: 21

Chi-square = 28.83

For significance at the .05 level, chi-square should be greater than or equal to 32.67.

The distribution is not significant.

p is less than or equal to 0.20.

References

- Apian Software, Inc. <http://www.apian.com>. Accessed Jan 2003.
- Arsham, Hossein, Dr., The Wright Distinguished Research Professor in Decision Science and Statistics, *Topics in Statistical Data Analysis, Ninth Edition*, Visited website on April 7, 2003: <http://ubmail.ubalt.edu/~harsham/stat-data/opre330.htm>
- Audubon Aquarium of the Americas, The. Retrieved February 5, 2003, from the World Wide Web: <http://www.auduboninstitute.org/aoa>
- Balisterie, Catherine. Worcester Art Museum. Personal interview for institution's visitor survey information. 11 Feb. 2003.
- Ball, Catherine N., *Web Chi Square Calculator*, Georgetown University, Visited website on April 27, 2003: http://www.georgetown.edu/faculty/ballc/webtools/web_chi.html
- Berdie, Doug R.; Anderson, John F. & Niebuhr, Marsha A. (1986). Questionnaires: Design and use (2nd ed.). Metuchen, NJ: Scarecrow Press.
- Blum, M. L. (1985). Data gathering: experimental methods plus. New York : Harper & Row.
- Booth-Kewley, S., Edwards, J.E., & Rosenfeld, P. (1992). Impression management, social desirability, and computer administration of attitude questionnaires: Does the computer make a difference? *Journal of Applied Psychology*, 77, 562-566.
- Brown, David. Personal Interview for Interface and HCI considerations. 7 Feb. 2003
- California Academy of Sciences, The. Retrieved February 5, 2003, from the World Wide Web: <http://www.calacademy.org>
- Chicago Museum of Science and Industry, The. Retrieved February 5, 2003, from the World Wide Web: <http://www.msichicago.org>
- Computer Museum of America, The. Retrieved February 5, 2003, from the World Wide Web: <http://www.computer-museum.org>
Copyright © Marketing Masters 1991-2001. Accessed Jan 2003
- Dargie, Hilary J., Dietrichsen, Matthew B., Isgro, Travis N. "Integration of Two Danish Museums" Conducted in Copenhagen, Denmark. 1999.
- DiGiacomo, Kerry. Philadelphia Museum of Art. Phone interview for institution's visitor survey information. 18 Feb. 2003.

- Doering, Zahava. Smithsonian Institute. Phone interview for institution's visitor survey information. 25 Feb. 2003.
- Doyle, James K. (2001). Chapter 10: Introduction to Survey Methodology and Design. Handbook for IQP Advisors and Students. Retrieved January 16, 2003. from the World Wide Web: <http://www.wpi.edu/Academics/Depts/IGSD/IQPHbook/ch10.html#10>
- Gambaro, Marianne. The Springfield Museums. Phone interview for institution's visitor survey information. 10 Feb. 2003.
- Garson, G. David, *Class PA 765 Quantitative Research in Public Administration*, a "ANOVA", North Carolina State University: 2003 Visited website on April 7, 2003: <http://www2.chass.ncsu.edu/garson/pa765/anova.htm>
- Greaud, V. A., & Green, B.F. (1986). Equivalence of conventional and computer presentation of speed tests. *Applied Psychology Measurements*. 10,23-34.
- Hayes, Bill. Museum of Flight. Email interview for institution's visitor survey information. 13 Feb. 2003.
- Haynes, Jeffrey F., Lawrence-Slavas, Noah, Mercado Edwin. "Marketability Study for the National Museum of Costa Rica" Conducted in San Jose, Costa Rica. 1999
- Hvass, Steen. (Ed.) (2001). The National Museum – Arbejdsmark 2000. Denmark: Phonix-Trykkeriet A/S, Aarhus.
- InvestorWords*, © 2000 *InvestorGuide.com, Inc.* Visited website on April 7, 2003: www.investorwords.com
- King, W. C., & Miles, E. W. (1995). A quasi-experimental assessment of the effect of computerizing noncognitive paper-and-pencil measurements: A test of measurement equivalence. *Journal of Applied Psychology*, 80, 643-651.
- Kisok Primer. <http://www.montegonet.com/kiosks101/primer.html> Accessed 24 Feb. 2003.
- Kozulin, Elena V., Snediker, Gerrett C., Zuk, Nicholas J. "Stereolithography Benefits to Museums" Conducted in Copenhagen, Denmark. 2001.
- Lautenschlager, G. J., & Flaherty, V. L. (1990). Computer administration of questions: More desirable or more social desirability? *Journal of Applied Psychology*, 75, 310-314.

- Lee, J. A., Moreno, K. E., & Sympson, J. B. (1986). The effects of mode of test administration on test performance. *Educational and Psychological Measurement*, 46, 727-733.
- Leones, Julie. (1998). A Guide to designing and conducting visitor surveys. The University of Arizona. Retrieved on January 24, 2003, from <http://ag.arizona.edu/pubs/marketing/az1056/>
- Leung, Wai-Ching. (2001). Conducting a survey. In Rhona MacDonald (Ed.), Student BMJ. British Medical Association. Retrieved January 19, 2003, from Expanded Academic ASAP online database
- Malley, Annie. California Academy of Sciences. Phone interview for institution's visitor survey information. 17 Feb. 2003.
- McCarthy, Philip J. (1979). Replication, an approach to the analysis of data from complex surveys. Hyattsville, Md.: Dept. of Health, Education, and Welfare, Public Health Service, Office of Health Research, Statistics, and Technology, National Center for Health Statistics.
- Milne, P.H. (1987). Computer graphics for surveying. New York: E. & F.N. Spon.
- Moser, C. & Kalton, G. (1979). *Survey methods in social investigation* (2nd ed.). Aldershot: Gower.
- Museum of Flight. Retrieved February 5, 2003, from the World Wide Web: [http:// www.museumofflight.org](http://www.museumofflight.org)
- Museum of Modern Art, The. Retrieved February 5, 2003, from the World Wide Web: [http:// www.moma.org](http://www.moma.org)
- Nass, C., Carney, P., & Moon, Y. (1999). Are people polite to computers? Responses to computer-based interviewing systems. *Journal of Applied Psychology*, 29, 1093-1110.
- Novinger, Anna. The Chicago Museum of Science and Industry. Phone interview for institution's visitor survey information. 12 Feb. 2003.
- Olenick, I. (1999). New Interview Technology Reveals Risky Behavior Among Adolescent Men. Planning Family Perspectives. Alan Guttmacher Institute. Retrieved January 18, 2003 from Expanded Academic ASAP online database
- Perseus SurveySolutions XP - User Guide (ssxp_manual.pdf). Downloaded from <http://www.perseus.com>. Copyright © Perseus Development Corporation 1997-2002.

- Philadelphia Museum of Art. Retrieved February 5, 2003, from the World Wide Web:
<http://www.philamuseum.org>
- Phillips John T., Jr. (1996). Software for surveys (Tracking Technology). Records Management Quarterly. Association of Records Managers and Administrators Inc. Retrieved January 19, 2003, from Expanded Academic ASAP online database
- Salant, P., & Dillman, D. A. (1994). How to Conduct your own Survey. New York: John Wiley & Sons, Inc.
- Sheppard, Jennie. The Dr. Pepper Museum and Free Enterprise Institute. Phone interview for institution's visitor survey information. 6 Feb. 2003.
- Smithsonian Institute, *Office of Policy and Analysis*, "A Manual for Interviewers", Report from 1999, Visited website on April 7, 2003: <http://www.si.edu/opanda>
- Smithsonian Institute. Retrieved February 5, 2003, from the World Wide Web:
<http://www.si.edu>
- StatPac for Windows Survey and Analysis Software Brochure (statpac_brochure.doc). Downloaded from <http://www.statpac.com>. Copyright © 2003 StatPac, Inc. Accessed Jan 2003.
- Survey Said SE/EE Reference Manual.
http://www.surveysaid.com/marketing_masters/manual2000/manidx.htm
- Tanga Winstead. Audubon Aquarium of the Americas. Phone interview for institution's visitor survey information. 19 Feb. 2003.
- The American Heritage® Dictionary of the English Language, Fourth Edition
Copyright © 2000 by Houghton Mifflin Company
- The Dr. Pepper Museum and Free Enterprise Institute. Retrieved February 5, 2003, from the World Wide Web: <http://www.drpeppermuseum.org>
- The Springfield Museums. Retrieved February 5, 2003, from the World Wide Web:
<http://www.quadrangle.org>
- US Environment Protection Agency, *Statistical Primer*, "Analysis of Variance (ANOVA)" Visited website on April 7, 2003:
<http://www.epa.gov/bioindicators/primer/anova.html>
- Wachtel, George. Museum of Modern Art. Phone interview for institution's visitor survey information. 19 Feb. 2003.

Weil, David. The Computer Museum. Phone interview for institution's visitor survey information. 5 Feb. 2003.

Worcester Art Museum, The .Retrieved February 5, 2003, from the World Wide Web:
[http:// www.worcesterart.org](http://www.worcesterart.org)