ANALYSIS OF THE CENSUS 2000 TELEPHONE QUESTIONNAIRE ASSISTANCE PROGRAM

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Abstract

During Census 2000, the Census Bureau provided an extensive Telephone Questionnaire Assistance (TQA) operation. National toll-free numbers were printed on the questionnaires in English, Spanish, and other languages. English toll-free numbers connected the caller to an Interactive Voice Recognition (IVR) system. Spanish toll-free numbers connected to an IVR with only touch tone capability. Once in the system, a caller made selections from menu options by touch tone or voice response. A caller could obtain information related to Census 2000 or request a mailed form. A call was transferred to an agent if the caller selected this option from the menu selection, or if the caller gave two invalid responses. The agent responded to the caller's request by accessing verbatim scripting in the Operator Support System (OSS). The OSS is a browser based application written in Hyper Text Markup Language (HTML) and Java (object-oriented, cross-platform programming language developed by Sun Microsystems). An agent conducted a short form interview if the caller requested the interview and met other criteria. This paper provides analysis of the TQA operation including, but not limited to the following: calling patterns and respondent behavior.

1. Introduction

As part of the 2000 census design, the Census Bureau implemented a telephone assistance program to provide assistance to the public in completing their census forms. To meet the program requirements the Census Bureau contracted with Electronic Data Systems (EDS). EDS leveraged state-of-the art technologies commonly used in customer service environments in the private sector. The major technologies included Intelligent Call Routing (ICR) software and Interactive Voice Response (IVR) technology coupled with a network of commercial call centers to function as a single virtual call center. The anticipated large call volume and short time frame of the program created a challenge in recruiting from the call center industry. This paper provides a profile of the TQA operation based on empirical analysis of the data collected

from the ICR, IVR, the agent desktop tool called the Operator Support System (OSS), and the telecommunications provider AT&T. And where appropriate, we will assess the performance of the TQA system. For the purposes of this paper, only English and Spanish calls are included in the analysis.

2. Background

The TQA network was available to the public through language specific toll-free numbers March 3 thru June 30, 2000. Callers could access the recorded IVR portion of the network 24 hours a day, 7 days a week. TQA agents were available 8am to 9pm for each time zone, 7 days a week (19hours a day). TQA provided the following services:

- Answered questions about the census and the census questionnaire.
- Allowed respondents to request a census form or language guide to be mailed to their home.
- Allowed callers who met certain criteria to respond to the census through TQA.

Agents could collect a callers census short form data only if one of the following conditions were met: A caller possessed a short form identification number and called prior to April 11 (*first list of housing units identified for Non-Response Follow-Up (NRFU)*) and indicated having difficulty reading or understanding the questionnaire; A caller who never received a form and called after all mail-out forms and most update/leave forms were delivered (*March 22*); or those who called after April 11 and did not have a census identification number.

The basic infrastructure design of the TQA network consisted of IVR systems and 22 call centers networked together as a virtual call center. ICR software routed calls from the AT&T network to the IVR systems, and if necessary, from the IVR to the Call Centers. The ICR routed calls to the IVR based on port capacity. If a caller needed to transfer to an agent, the ICR could view call activity at the individual agent level and route the call to the most available agent across the network. (Bureau of the Cenus, 2001).

The IVR system was based on telephone technology that allowed callers to enter information and obtain information by selecting a series of menu options by touch tone or for English speaking callers, voice

response. An IVR is ideal for handling routine inquiries. Users interact with a computer by using their telephone as a terminal. The objective of the system is to provide users with information without being transferred to an agent (Hayes, 1999). For TQA, a caller was transferred to an operator if the caller gave two invalid responses to a menu, selected a menu option that automatically transferred the caller, or chose to speak with an agent .

Other potential benefits of an IVR system are: reduced operation cost, standardized customer service, 24 hour access to information, reduced peak call loads, increased reliability of information, and diminished 'hold' and 'busy' signals and no-ring answers. (Hayes, 1999).

Three IVR scripts were designed to correspond to the three different phases of Census 2000. These phases were:

- Phase 1 (March 3 - March 21, 2000) - Update/Leave Mail Delivery, this operation entailed updating Census Bureau maps and address listings and leaving questionnaires at the housing units.
- Phase 2 (March 22 - April 7, 2000) - All questionnaires delivered.
- Phase 3 (April 8 - July 7, 2000) - Housing units are identified for NRFU thru the completion of the NRFU operation.

The method in which the IVR handled requests for a census form defined the major difference in scripting across the three phases. In phase 1, a caller could not request a census form since not all forms had been delivered. In phase 2, a caller could request a census form without transferring to an agent. In phase 3, if a caller requested a census form, the caller was transferred to an agent who then either collected their census data or told the caller that a census worker would visit them at their home.

An operator responded to a caller's request through a browser based desktop tool, written in HTML and Java, referred to as the OSS. The OSS was network accessible by the 22 call centers. The OSS contained information the operator needed to answer census related questions, take mailing address information for mailing a census form or language assistance guide upon request, or conduct short form interviews given the caller met certain criteria.

3. Data Sources

The data used in this paper to profile the TQA program came from four separate sources. Daily reports of the IVR and OSS call volumes were provided by AT&T. The ICR software provided various reports as well as call record data that tracked time and date information. The IVR provided caller behavior information such as the menu options selected by a caller. Similarly, the OSS provided data for many of the screens accessed by an agent while servicing a caller.

Note that there were some problems with the reporting data. Not all of the data sources were in agreement - this indicated a loss of report data. Problems with report data output were not identified prior to operations because of the compressed development schedule for the program which did not allow us to adequately test the data reports from the various components of the system.

AT&T reported the largest call volume of all the data sources. Thus, we conclude that AT&T is the most reliable data source.

Because we do not know the source of the failures in data reporting to assess the bias, analysis will be based on non-scientific samples of the overall call universe. Note that all statistics produced will cite the data source.

For the purposes of this paper we will not discuss all of the discrepancies between the data sources but give just one example. A comparison in call volume between the ICR and AT&T shows the ICR component failed to output reporting data for approximately 1.8 million calls. Ideally these two sources should be in agreement. In Figure 1 (Appendix), we observe the days where the ICR problems occurred as March 13 thru March 15, March 20 thru March 25, and March 27 thru April 1. According to the AT&T data, this was during the peak of the operation. The ICR reporting failures were due to some problems in programming the software early in the operation. The ICR problems were a disappointment to the TQA program because of the data and reporting capabilities that were lost. (Bureau of the Cenus, 2001).

4. Results

4.1 Call Volume

The TQA operation was conducted from March 3 to June 30. The system was designed to accommodate 11 million calls, but only received slightly under 6 million English and Spanish calls throughout the operation as seen in Table 1.

Table 1. Call Volume for each Call Type

	Count	Percent
IVR Resolved	2,736,009	47.3%
Agent	2,829,403	48.9%
Incompletes	217,829	3.8%
Total Calls	5,783,241	100.0%

Data Source: AT&T

An IVR resolved call is defined as a call that was not transferred from the IVR system to an agent. From Table 1, we see that almost half of the total calls received were resolved in the IVR. This exceeded the Census Bureau and contractor's projected resolution rate of 40%. The high IVR resolution rate shows that the IVR worked well in reducing the agent call workload. Also, this statistic suggests that the IVR worked well in meeting the public's needs in regard to the census though we cannot say this definitively without assessing customer satisfaction data.

The total number of agent calls reported in Table 1 was derived by subtracting the number of IVR resolved calls and the number of incomplete calls from the total number of calls. Note that incomplete calls are defined as blocked either at the Network (AT&T) level or the premise (TQA) level.

Figure 1 (Appendix) shows that the first peak in the call volume occurred after March 13, which corresponds to the initial mail out of Census 2000 questionnaires. The second, also the largest peak occurred after March 19, which corresponds to the mail out of the Census 2000 reminder post card. This peak resulted in over 700,000 calls. Following this is a third peak which occurs in anticipation of Census Day April 1, after which calls taper-off to June 30.

4.2 IVR

All English and Spanish calls were routed directly to an IVR. We define an IVR resolved call as any call that was not offered to an agent. As mentioned in the background section, it is more beneficial for a call to be resolved by the IVR than an agent. Thus, it is interesting to look at the percent of calls resolved in the IVR by phase of the census to gauge the effectiveness of the IVR.

From Table 2, we see a slight increase in the IVR resolution rate, moving from phase 1 to phase 2. When we move into phase 3, we see a 20 percentage point drop in the resolution rate. However, we notice the call volume is considerably less for phase 3. Thus, the drop in resolution rate did not negatively impact the TQA program.

Table 2. IVR Resolved Calls by Census Phase

	Phase 1	Phase 2	Phase 3	All Phases
IVR Resolution Rate	46.8%	51.7%	30.2%	47.3%
Call Volume	2,956,552	2,317,783	508,906	5,783,241

Data Source: AT&T

To further investigate the drop in IVR resolution rate for phase 3, we want to view the daily IVR resolution rates. In Figure 2 (Appendix), we see large fluctuations in

phase 1, and then a nice trend in phase 2 where the rate stays at or above 50%. And as mentioned in the previous table, we see a dramatic drop in the IVR resolution rate at the very beginning of phase 3 and then a gradual rise through the remainder of the operation. Because the drop occurred at the beginning of phase 3, we suspect that the change in scripting for phase 3 affected the IVR resolution rate.

If we look at the menu selections in the IVR for each phase of the census, we can determine if the differences between scripts for each phase affected the percent of calls resolved at the IVR. Table 6 (Appendix) shows the percent distribution of menu options selected in the IVR for each phase of the census. Please note, the dashes indicate the menu option was not offered during that particular phase.

Notice that 60% of the menu selections in the IVR for phase 1 are for "FAQ about completing Census Form" and then 22% are for "Reminder Postcard". In phase 2, we introduce a new menu option "Need a Census Form", this draws 56.2% of the menu selections. "FAQ" is now only 25%. In phase 3, the "Need a Census Form" option is removed and we shift back to "FAQ" as the most frequently selected option. Note that we added a new option "Have not Received a Census Form". The significance of this option is that it transferred a caller to an operator. In phase 1 and 2 there were only two ways to transfer to an operator - 2 invalid responses or pressing 0. Because 20% of the menu selections in phase 3 were for this option, we conclude that the method for handling the issue of respondents having not received a form led to the decrease in the IVR resolution rate in Phase 3 as seen in the previous graph.

4.3 OSS/Agent

Callers were transferred to an agent if they gave two invalid responses in the IVR, selected to speak with an agent, or gave a response that automatically transferred the caller to an agent. Once a caller was transferred to an agent, depending on the phase of the census and other criteria, the agent could address questions about the census and its operations, provide information about the questions on the census forms, field requests for forms or language guides, or take a census short form interviews.

Table 3 shows that 50.6% of the calls handled by an agent were callers requesting information only. And, 34.5 % of the calls were requests for a census form or a Language Assistance Guide (LAG) (a brochure or guide available in 49 languages other than English that assisted non-English respondents in filling out their English census form).

Notice that 14.9% of the calls that went to an operator were for a short form interview. This is an anticipated result because we designed the OSS scripting to limit the number of calls going to an interview due to

cost considerations and the potential impact to agent staffing for such a high call volume program.

Table 3. OSS call types

	Count	Percent
Info	862,265	50.6%
Census Form Request or LAG Request	588,732	34.5%
Interview	253,806	14.9%
Total	1,704,803	100.0%

Data Source: OSS evaluation file

4.4 Time Lengths for each Call Type

We would expect the time length of a call to vary, depending on the call type. Table 4 shows mean call times for the IVR component of TQA broken down into whether the call was resolved in the IVR or unresolved(transferred to an agent). On average a caller spent 2 minutes and 21 seconds in the IVR. In general, an IVR resolved call took less time than an IVR unresolved call.

Table 4. IVR Call Times

	Mean Time (h:mm:ss)
IVR	0:02:21
IVR Resolved	
Info	0:01:54
Form Request	0:02:22
IVR Unresolved	
Info	0:02:48
Form Request	0:02:50

Data Source: ICR and OSS evaluation files
Maximum Call Time: 0:08:19

For an IVR resolved call or caller that did not transfer to an agent we see an increase in the amount of time a caller spent in the IVR when going from an information only call to a census form request call.

For an IVR unresolved call or caller that did transfer to an agent, the average call times for an information only call and a census form request are approximately the same. Thus we see that Call type does not affect the amount of time a caller spends in the IVR if the caller was not able to resolve their issue in the IVR.

In comparison to the IVR we see from Table 5, that if a caller was serviced by an agent, a caller spent on average 2 minutes longer speaking to an agent than with an IVR. Thus, calls are handled more efficiently by the IVR. However, callers that are transferred to an operator may not have had their question answered by the IVR and thus may require more explanation or service than what was available in the IVR.

Table 5. OSS/Agent Call Times

	Mean Time (h:mm:ss)
OSS/Agent	0:04:25
Info (Agent)	0:03:36
Form Request or Language Assistance Guide (Agent)	0:03:46
Interview (Total Agent Time)	0:08:01

Data Source: ICR and OSS evaluation files
Maximum Call Time: 1:23:12

In Table 5 we see a slight increase in the average call time when going from an information only call to a census form request or language assistance guide request. Then we see a large increase in the average call time for a call whenever an operator conducted a census short form interview. Note this includes time leading up to an interview.

As a comparison, on average the paper census short form takes a respondent 10 minutes to fill out, 2 minutes longer than if the respondent gave their information through TQA.

5. Conclusions

The purpose of this paper was to profile the TQA program through a few different perspectives such as call volume, IVR resolution rates, and call times for the different types of calls or services offered by TQA. In addition we were able to make some conclusions about the performance of the system.

The TQA program in general was a success considering 6 million callers were serviced. However, the problems we encountered with the loss of report data were a downside to the program. This affected the analysis by limiting us to non-scientific samples of the population. Also, the lack of reports forced program managers to come up with secondary sources of information, none of which were as specific as the intended reports.

In regard to the IVR component of the TQA program, we were able to see from our results the benefits of utilizing IVR technology. The IVR resolution rate exceeded the Census Bureau and contractor's resolution rate. A higher resolution rate increased the volume of calls

resolved by the IVR and reduced the volume of calls transferred to an agent/operator. In addition, from our call time analysis we observed that the IVR handled calls more efficiently than an agent given that the call was resolved in the IVR.

In conducting future research, we need to investigate the drop in resolution rate we observed in phase 3 and research how we can meet the needs of those callers in the IVR without compromising customer satisfaction. In general, we need to work on keeping the IVR resolution rate consistent throughout the program. Note, this analysis is part of a larger Census 2000 evaluation to be released in April 2002.

6. References

Bureau of the Census (1998), Telephone Questionnaire Assistance Contract (contract no. 50-YABC-9-66001), Washington, D.C. December, 23.

Bureau of the Census (2001), "TQA and CEFU Lessons Learned," internal memorandum, Washington, D.C. January, 26.

Hayes, A. (1999), "Interactive Voice Response and Kiosk Technology: Research Paper," Corporate Services Reform, Premier's Department Sydney, NSW Australia, December.

Appendix

Table 6. Percent Distribution of Menu Selections by Phase of the Census

	Need a Census Form	Have Not Received a Census Form	FAQ's about Completing Census form	Reminder Post Card	Other Options	General Infomation about the Census	Total
Phase 1	----	----	59.8%	21.8%	3.2%	15.2%	100.0%
Phase 2	56.2%	----	24.9%	10.0%	1.8%	7.1%	100.0%
Phase 3	----	19.8%	49.5%	----	7.9%	22.8%	100.0%

Data Source: IVR Evaluation File
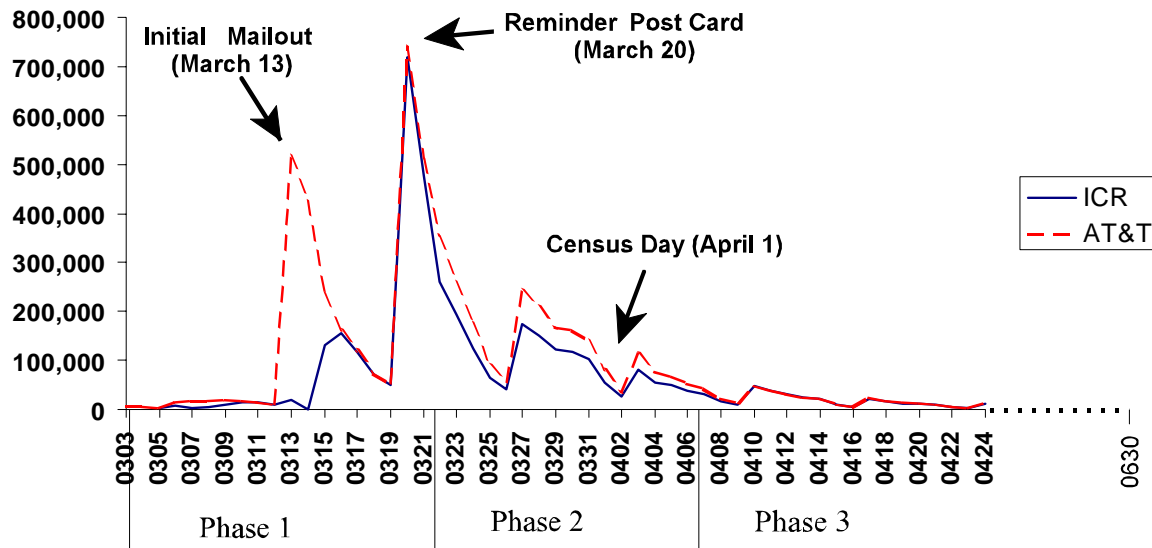
Figure 1. Call Volume As Reported by AT&T and ICR

Figure 2. Daily IVR Resolution Rates As Reported by AT&T