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Problems With Telephone Surveys

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Abstract

This paper examines data from the November 1985 California Fall Acreage and Production Survey, conducted with CATI, in an attempt to study optimal timing of telephone contacts. The evening hours from 6 to 9 are optimal from the perspective of highest operator contact rate. The paper also studies the distribution of the number of attempts necessary to complete a contact, which is higher for larger operations, and when the operator or another knowledgeable individual is the respondent. Calls resulting in busy, no-answer, or callback responses are examined to determine optimal timing for the return call.

Keywords: CATI timing, Number of attempts, Callback timing

* This paper was prepared for limited distribution to the *
* research community outside the U.S. Department of Agriculture.*

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Summary

Many things affect the response rate and the quality of data collected over the telephone. Data collected for the 1985 Fall Acreage and Production Survey in California with CATI was analyzed for trends due to timing of the contact attempt, number of attempts made, and the respondent.

There is some evidence of a difference in the number of calls required to contact the operator, spouse, and other knowledgeable individual categories of respondent. It tends to be more difficult to contact the larger operations, no matter what category of respondent.

The evening hours between 6 and 9 consistently appear to be the best times to make a successful contact, particularly with a farm operator. Analysis of the callback information provided by contacts with the operation indicate that evening hours dominate the times given for a callback to be performed. Additional analysis of the calls immediately following a call which resulted in a busy or a no-answer outcome gave some insight into the timing of followup calls. The data suggest that following a busy signal, a followup call should be made between 15 and 30 minutes later. Following a no-answer response, followup calls should be made no sooner than 2 hours later. Probability of a successful contact is affected by the size of the operation. In particular, operations with 40 to 80 acres of land in the farm had a significantly higher probability of completion compared with operations of any other size.

Some caution should be used in generalizing results obtained from this study since the data analyzed represent one State (California) in 1 month (November 1985), and for one survey (Acreage and Production). In addition, the sample was specifically selected to contain small grain operators.

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Introduction

The problems of contacting a person on the telephone in order to conduct a telephone interview are numerous. Wiseman and McDonald (1979) listed six reasons for noncontact as follows:

1. The person to be contacted is not at home at the time of the interview attempt.
2. The person to be contacted is at home but does not get to the telephone in time to respond.
3. The person to be contacted has a telephone which is busy at the time of the contact attempt.
4. The person to be contacted has a telephone which is unlisted, disconnected, or which has an unpublished number.
5. The person to be contacted does not have a telephone.
6. The person to be contacted was not contacted; some other member of the family answered the call and refused to participate in the survey.

Wiseman and McDonald reported a median noncontact rate of 50.6 percent in a single contact attempt, and 23.5 percent after four attempts had been made. This non-contact rate is a function of four variables as follows:

1. The number of contact attempts made.
2. The number of times that the telephone is allowed to ring before the enumerator moves to another call.
3. The timing of the attempt, both day of the week and time of day.
4. Whether there is some change in technique made on the second and subsequent calls.

Very little work addressing these points has been reported, and there are no data in the context of surveys of farm operators available in the literature. Much of the information on timing of telephone interviews is the result of experience and folklore. There is a need to quantify and verify this material. This paper examines data from the California Fall Acreage and Production Survey (A & P) of November 1985 from the perspective of the number of attempts made and the timing of the attempts made within the day.

Review of Literature

Table 1, reproduced from Groves and Kahn (1979), gives the distribution they observed for the number of calls required in order to complete a telephone interview. The data referenced are based solely on telephone calls made to working household numbers during two nationwide random digit dialing surveys.

Table 1. Distribution of the number of attempts required to complete a telephone call

Attempt	% completed on this attempt	Cumulative % completed	Attempt #	% completed on this attempt	Cumulative % completed
1	23.7	23.7	10	1.8	92.8
2	18.0	41.7	11	1.3	94.1
3	13.7	55.4	12	1.2	95.3
4	11.1	66.5	13	1.1	96.4
5	8.0	74.5	14	.8	97.2
6	6.0	80.5	15	.3	97.5
7	5.0	85.5	16	.5	98.0
8	2.9	88.4	17+	1.9	99.9
9	2.6	91.0			

Mean number of attempts needed to complete a call = 3.4.
 Median number of attempts needed to complete a call < 2.
 Sample size on which the table is based = 2,311.
 Source: Groves and Kahn (1979).

A study by Weeks, Jones, Folsom, and Benrud (1980) showed Saturday to be the best day to contact individuals 14 years of age or older, and that the late afternoon and early evening (3 to 8) were the optimal times. They observed no difference due to race of the respondent, but did observe that rural respondents were easier to contact than urban respondents. They reported a decline in the response rates since 1960 for any hour of the day, but in particular for the early morning hours. For the studies reported in their paper, the 9 a.m. to 10 a.m. response rate in 1960 was 71 percent, declining to 56 percent in 1971, and to 39 percent in 1976. This was the most extreme case. At a more usual time (7 p.m. to 8 p.m.), a similar but less extreme trend was observed: 80 percent in 1960, 71 percent in 1971, and 66 percent in 1976.

Parts of these results conflict with the results reported by Rogers (1976) in which she concluded that weekdays yielded better response rates for a telephone interview. She also provided data showing a 34-percent first attempt success rate, 27-percent second attempt success rate, and 40-percent success on the third or subsequent attempts. Her interviews took about 50 minutes to complete. A summary of her response rates for each day of the week is given in table 2.

Table 2. Completed telephone interviews by day of week

Mon	Tues	Wed	Thurs	Fri*	Sat	Sun
24%	22%	14%	19%	11%	6%	5%

* Rogers commented that Friday may not be representative as that was the day on which reports were to be made to the head office.

Source: Rogers(1976).

Falthzik (1972) reported that, in a sample of 1,260 calls made in Maryland to housewives and female heads of households, he encountered a higher refusal rate on weekends, and that the refusal rate was highest in the evenings and lowest in the mornings. He found 54 business listings in his sample after making the calls, but designed his study in order to call 20 numbers in each of three 3-hour time periods on each of the 21 days in a 3-week period. Only one call per number was attempted and the result was recorded as a completion, refusal, or a not-at-home (NAH). The three time periods chosen were from 9 a.m. to noon (A), 2:30 p.m. to 5:30 p.m. (B), and 7 p.m. to 10 p.m. (C). His main results appear in tables 3 and 4.

Table 3. Result of telephone calls by time of day

Result	A (9a.m.-noon)		B (2:30p.m.-5:30p.m.)		C (7p.m.-10p.m.)		Total	
	Count	%	Count	%	Count	%	Count	%
Completed	136	35.1	75	18.0	105	26.2	316	26.2
Refusal	68	17.6	126	30.2	146	36.5	340	28.2
NAH	183	47.3	216	51.8	149	37.3	548	45.6
Total	387	100.0	417	100.0	400	100.0	1,204	100.0

Source: Falthzik (1972).

Table 4. Result of telephone calls by day of the week

Day	Completed		Refusal		NAH		Total	
	Count	%	Count	%	Count	%	Count	%
Mon	65	38.2	34	20.0	71	41.8	170	100
Tue	41	24.0	40	23.4	90	52.6	171	100
Wed	53	31.4	40	23.7	76	44.9	169	100
Thu	50	29.4	49	28.8	71	41.8	170	100
Fri	32	18.8	40	23.5	98	57.6	170	100
Sat	38	21.2	65	36.3	76	42.5	179	100
Sun	37	21.1	72	41.1	66	37.7	175	100
Total	315	26.2	340	28.2	548	45.6	1,204	100

Source: Falthzik (1972).

The differences noted in the latter table are significant with a chi-square statistic of 57.728 (df=12, p<.01), and show relatively high not-at-home rates on Tuesday and Friday, relatively high refusal rates on Saturday and Sunday, and a curiously high completion rate on Monday. The Monday result may be a function of a Federal Monday holiday since the study was conducted in Maryland

close to Washington, D.C. Falzhzik does not document the month or dates of his study in order to confirm or refute this possibility.

Frey (1983) commented that within the weekday evening hours of 5:30 to 9, the hour from 6 to 7 ranked highest in terms of potential completions, even for his studies in Las Vegas which he commented is a "24-hour" community. He also commented on the various patterns of local importance which must be taken into account when planning a telephone interviewing survey. Friday evenings in smaller, rural communities were found to be relatively unproductive due to the tendency to schedule school and church activities on that night. He noted that taking advantage of a Friday snowstorm in the northeast (rural) counties of Nevada had resulted in a higher-than-usual completion rate for those counties on that occasion.

Vigderhouse (1981) reported on a telephone survey conducted in Ontario and Quebec. The interview lasted 10 minutes and calls were made on weekdays only (Monday through Friday) between 9 a.m. and 9 p.m. A maximum of six callbacks was allowed. The calls were made to working listed and unlisted numbers (Vigderhouse was an employee of the Canadian Telephone Company and had access to the latter). He gives no data on response rates by day of the week, but his completion rates by time of day and month in which the call was made are given in table 5 and the overall completion rates as a proportion of total dialings were as follows:

	a.m.								p.m.	
Time	9-11	11-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	
Rate	.279	.302	.388	.333	.391	.352	.436	.407	.412	

Table 5. Results of Canadian telephone survey

Time	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan
9-11	0.284	0.353	0.310	0.394	0.269	0.218	0.229	0.239	0.310	0.273	0.227	0.244
11- 2	.351	.333	.340	.293	.259	.266	.199	.291	.322	.310	.268	.387
2- 3	.420	.370	.430	.403	.344	.318	.253	.286	.334	.374	.243	.279
3- 4	.349	.466	.464	.313	.272	.284	.283	.297	.332	.340	.251	.345
4- 5	.553	.514	.443	.373	.305	.369	.373	.387	.352	.391	.324	.302
5- 6	.459	.331	.430	.378	.294	.396	.286	.331	.425	.302	.286	.307
6- 7	.479	.505	.514	.456	.379	.350	.414	.425	.496	.419	.306	.484
7- 8	.543	.401	.457	.388	.340	.346	.451	.432	.444	.323	.357	.404
8- 9	.441	.451	.500	.432	.393	.390	.410	.526	.368	.408	.118	.511
Total	.283	.290	.294	.269	.237	.240	.238	.258	.269	.261	.208	.268
n	2453	2427	2469	2191	2589	3142	3216	3143	3216	3143	3258	2833
m	5519	5381	5421	6134	5168	5834	7023	6764	6697	6845	5560	6189
Resp	63.7	64.4	64.6	61.3	55.8	54.1	53.1	53.1	44.3	54.8	40.8	56.3

n = sample size.

m = total number of dialings.

Resp = response rate.

Main body of the table is the completion rate as a proportion of m.

All times quoted are from the beginning hour to 1 minute prior to the ending hour.

Source: Vigderhouse (1981)

Smead and Wilcox (1980) commented that, in a telephone survey, it is usually sufficient to allow no more than five rings before progressing to the next call on the enumerator's list. Their study showed that, in a controlled situation, 97 percent of those who were at home had responded to the telephone within four rings and 99 percent had responded within five.

Also, in a review of 157 market opinion surveys reported by major companies, Wiseman and McDonald (1979) gave the median noncontact rate for those which allowed five or fewer rings and those with more than five rings for one, two, three, and four or more attempts made to reach a respondent at the number being called. A summary of their results is given in table 6.

The noncontact rate generally decreased as more attempts were made to contact an individual and as more time was allowed for the person called to reach the telephone (that is, as more rings of the telephone were allowed).

Table 6. Median noncontact rates for 157 surveys

Number of rings allowed	Number of attempts made to contact respondent				Overall
	1	2	3	4+	
<=5	50.0%	45.7%	32.0%	20.0%	
>5	43.3%	36.0%	21.6%	22.0%	
Overall	50.6%	44.2%	32.2%	23.5%	39.1%

Source: Wiseman and McDonald (1979).

Although the research reviewed above is generally in the context of public opinion polling of the general public, several of the points made may well be relevant to NASS farm operator surveys. It is of considerable interest to determine the optimal day and time-of-day for contacting farm operators in these surveys. In the 1985 June Enumerative Survey (JES), for example, the farm operator was the contact person for 69 percent of the total agricultural tracts, the spouse for 11 percent, and another knowledgeable person for 13 percent. The farm operator contact rate varied from a low of 57 percent in Colorado to a high of 79 percent in North Carolina. For data from the September Crop Integrated Survey Program (CRISP) in nine States (Georgia, Indiana, Iowa, Kansas, Minnesota, Missouri, Nebraska, North Carolina, and Ohio) the farm operator contact rate varied from 67 to 88 percent. A more complete analysis of this data is given in Warde (1986).

Results

Data from the California A & P were examined to detect any discernible trends in agency data. These data were collected using Computer Assisted Telephone Interviewing (CATI). The original sample selected contained 1,920 farm operations, all of which had previously been contacted in the June Acreage survey. Calling began on Tuesday, November 12, and ended on Monday, November 25. No calls were made on Fridays, Saturdays, or Sundays during this period, thus

giving 8 working days. The main scheduled time for calls during the first 3 working days of the survey was from 3 p.m. until 9 p.m. For the remainder of the survey (5 working days), calling was generally scheduled from 1 p.m. until 9 p.m., with one supervisory enumerator making morning callbacks. On November 19, five of the enumerators started work at noon and on the last day of the survey, 2 of the 10 enumerators worked in the morning in an effort to complete the survey. A total of 5,354 contact attempts were coded, resulting in 1,642 completed contacts, 78 refusals, and 200 incomplete responses. Of the latter group, 41 were noted to be inaccessible by telephone. These were not followed up in this survey. Of those who refused, there were 11 who commented that they would not provide the data desired on the telephone, and 3 more who preferred to give their information by mail. A breakdown of the comments (if any) noted by the enumerators in the case of a refusal is as follows:

Table 7. Reasons for refusals in California November 1985 A & P Survey

<u>Reason given for refusal</u>	<u>Count</u>	<u>Percent</u>
Will not give information on the phone	10	12.8
Prefers a mail questionnaire	3	3.8
Will not give on phone & wants a mail questionnaire	1	1.3
Not convenient this time	4	5.1
Refusal but enumerator notes operator is still farming	7	9.0
Recently had a similar call	2	2.6
Other comment	9	11.5
No comment recorded	42	53.8
<u>Total</u>	<u>78</u>	<u>100.0</u>

The results of each contact attempt were recorded by the enumerators on a call sheet containing the date and time of the attempt in addition to a designation that the call resulted in a completion, refusal, no answer, busy, or a callback. The CATI system also created a record (known as the 00 record) which contained a date and time record of every occasion on which the information for the farm operation was called up on the computer screen by the enumerator. Outcomes recorded on the call sheets by the enumerators were checked against the CATI-generated 00 records. A number of discrepancies between the two records were found and were resolved by the researcher as follows:

1. No CATI record for the case in the computer. This was usually due to there being no telephone information available for the operation. A CATI 00 record was created with the outcome coded as inaccessible by telephone.
2. No CATI record but the enumerator record showed that an attempt had been made. A CATI 00 record was created with an outcome coded to match the enumerator recorded data.
3. A CATI 00 record existed but no recorded outcome was available from the enumerator record. The outcome was recorded as other.

For the purposes of this study, the terms "completion" and "complete a call" refer only to those attempts for which the enumerator recorded a completed interview, and do not include refusals or any other outcomes.

The number of attempts required in order to complete a call varied as a function of the outcome of the contact. For those calls which were completed, table 8 gives the distribution of the number of contact attempts required for each of the three classifications of respondent: operator, spouse, and other knowledgeable individual. These responses are separated into the three strata used in the study as well as the overall rates by respondent. Stratum 1 generally consists of small operations, stratum 2 medium sized operations, and stratum 3 large operations. Specific definitions of the strata used are given in Appendix A.

The effort required, as measured by the average number of contact attempts required to complete a call, tends to increase with the size of the farm operation. This observed trend, however, is statistically significant only when spouses were the respondent (for operators, chi-square = 30.75, df = 22, P = .101; for spouses, chi-square = 30.34, df = 18, P = .034; for others, chi-square = 11.82, df = 12, P = .460). Note that the enumerators were not instructed to make any extra efforts to obtain a response from the larger operations. Hence, the extra effort required for contacting these operations can be attributed to the difficulty in obtaining a qualified respondent and not to any extra concern by the survey administrators to complete these particular responses.

The distribution across strata of the number of responses for each type of respondent is significant (chi-square = 35.09, df = 4, P < .001). There are far more responses by the spouse for the smaller operations and far more responses by other knowledgeable individuals for the larger operations than would be expected if respondents were equally likely to be contacted in all three strata. This pattern reflects the observation that spouses are not likely to be able to answer the questions posed for the larger operations (see Warde, 1986, among others), and also the likelihood of data being provided by an accountant or a bookkeeper for some larger operations. In California, some hired farm managers will have been coded as operators if their name was listed in the secondary name position on the interview schedule.

The overall distributions in table 8 are significantly different from those observed by Groves and Kahn and given in table 1 (for operator, chi-square = 311.194; for spouse, chi-square = 64.409; for other, chi-square = 21.563; all collapsed to 9 degrees of freedom by combining the tails of their distributions to a category containing 10 or more calls). This is not too surprising for several reasons:

Table 8. Distribution of the number of attempts required to complete a telephone interview by respondent type and stratum, California A & P, November 1985*

Stratum	1		2		3		Overall	
Attempt number	%	cum %	%	cum %	%	cum %	%	cum %
For farm operators as the respondent:								
1	40.3	40.3	40.0	40.0	35.1	35.1	38.5	38.5
2	25.7	66.0	26.7	66.7	29.0	64.1	27.1	65.6
3	17.0	83.0	13.6	80.2	15.3	79.3	15.3	80.8
4	9.4	92.4	9.7	89.9	7.6	87.0	8.9	89.8
5	2.9	95.3	3.0	92.9	4.3	91.2	3.4	93.1
6	1.6	96.9	3.0	95.9	4.0	95.2	2.9	96.0
7	2.0	98.9	.9	96.8	2.0	97.2	1.6	97.6
8	.5	99.4	2.4	99.2	.9	98.1	1.3	98.9
9	.5	99.8	.7	99.8	1.1	99.2	.7	99.6
10	0	99.8	0	99.8	.5	99.7	.1	99.8
11	.2	100.0	.2	100.0	0	99.7	.1	99.9
12					0	99.7	0	99.9
13					.2	100.0	.1	100.0
mean	2.28		2.39		2.54		2.40	
n	447		465		445		1,357	
For spouses of farm operators as the respondent:								
1	60.6	60.6	34.6	34.6	35.5	35.5	46.5	46.5
2	18.3	78.9	30.9	65.5	19.4	54.8	22.9	69.4
3	8.5	87.3	16.4	81.8	12.9	67.7	12.1	81.5
4	8.5	95.8	12.7	94.5	12.9	80.6	10.8	92.4
5	2.8	98.6	1.8	96.4	3.2	83.9	2.5	94.9
6	0	98.6	3.6	100.0	3.2	87.1	1.9	96.8
7	0	98.6			6.5	93.6	1.3	98.1
8	0	98.6			0	93.6	0	98.1
9	0	98.6			0	93.6	0	98.1
10	0	98.6			3.2	96.8	.6	98.7
11	0	98.6			3.2	100.0	.6	99.4
12	1.4	100.0					.6	100.0
mean	1.87		2.27		3.13		2.26	
n	71		55		31		157	
For other knowledgeable individuals as the respondent:								
1	47.4	47.4	37.5	37.5	24.4	24.4	32.5	32.5
2	10.5	57.9	37.5	75.0	24.4	48.9	23.7	56.3
3	10.5	68.4	6.3	81.3	8.9	57.8	8.8	65.0
4	0	68.4	6.3	87.5	15.6	73.3	10.0	75.0
5	15.8	84.2	12.5	100.0	15.6	88.9	15.0	90.0
6	5.3	89.5			6.7	95.5	5.0	95.0
7	10.5	100.0			4.4	100.0	5.0	100.0
mean	3.05		2.19		3.11		2.86	
n	19		16		45		80	

* Total completed responses in Table 8 are 1,594 since 16 completed responses did not have respondent information, 29 completed responses were coded with out of business as the respondent information, and 3 completed responses were coded with refusal as the respondent information.

1. Table 1 reflects random digit dialed numbers whereas table 8 generally reflects known telephone numbers for individuals who had been contacted 5 months earlier during the JES.
2. Table 1 reflects a nationwide survey of households whereas table 8 reflects a Statewide survey of farm operations in California.
3. Table 1 reflects any responsible adult whereas table 8 reflects attempts to contact a person "knowledgeable of the farming operation."

Table 9 shows the distribution of outcomes as a function of the number of attempts made to contact an operation. The probability of a completion can be seen to decrease as more attempts to contact an operation are made, particularly after the fourth attempt. This trend is in part due to the early successful completion of interviews with those respondents who are relatively easy to contact, leaving those who are "in-and-out" or otherwise difficult to contact to make up those cases for which a large number of attempts to contact are required. This interpretation of this trend is reinforced further by the increase in the percentage of no-answer outcomes as the number of attempts made to contact an operation increases.

Table 9 also indicates the number of contacts terminated at each call with an incomplete outcome and gives a breakdown of these. Most of those terminated early are contacts where no phone number was available or where the phone number provided was incorrect and no new phone number could be obtained. Incomplete responses due to callbacks occur at each level of calls. These are typically due to a contact being made for which the information provided indicates that no one will be available to respond to the questions until some date after the termination of the sampling period. Most of the incomplete responses coded for calls eight or more are no-answer codes and frequently were from situations where every attempt to call that operation had resulted in no answer.

A comparison of the completion rates using z-tests shows that there is no significant difference among completion rates for calls one through four, and no significant difference among completion rates for calls five through seven. Any of the completion rates for calls one through four are significantly different from any completion rate for calls five through seven, and any of the completion rates for calls one through seven are significantly different from the composite completion rate for call eight or more. In addition, if we compare the completion rate for early calls (defined as all calls up to and including call 1), with later calls (all calls from call i+1 on), then the early response completion rate is always significantly larger than the later response completion rate. See table 10 for the summary of these z-tests.

Table 9. November A & P outcome by attempt to contact

Outcome	Number of the attempt made to contact respondent *							
	1		2		3		4	
	#	%	#	%	#	%	#	%
Complete	644	33.5	432	35.8	237	31.7	151	31.4
Refusal	32	1.7	14	1.2	11	1.5	7	1.5
Callback	414	21.6	195	16.2	145	19.4	82	17.0
No answer	537	28.0	394	32.7	251	33.6	163	33.9
Busy	204	10.6	105	8.7	59	7.9	56	11.6
Other@	89	4.7	66	5.5	44	5.9	22	4.6
Total	1,920	100.0	1,206	100.0	747	100.0	481	100.0
Incomplete	38		13		18		15	
Callback	2		5		11		8	
No phone	33		4		3		0	
Other	3		4		4		7	

	Number of the attempt made to contact respondent *							
	5		6		7		>7	
	#	%	#	%	#	%	#	%
Complete	64	20.8	49	21.9	28	18.4	37	11.3
Refusal	5	1.6	4	1.8	2	1.3	3	0.9
Callback	60	19.5	24	10.7	21	13.8	29	8.8
No answer	127	41.2	110	49.1	82	53.9	195	59.5
Busy	22	7.1	19	8.5	10	6.6	34	10.4
Other@	30	9.8	18	8.0	9	6.0	30	9.1
Total	308	100.0	224	100.0	152	100.0	328	100.0
Incomplete	15		20		11		71	
Callback	10		6		6		14	
No phone	0		1		0		0	
Other	5		13		5		57	

* Note that some cases are terminated at each call with outcomes other than complete or refusal. These form the 200 incomplete responses.

@ The category "other" includes outcomes coded as telephone noise or telephone problems including reaching bad numbers, operations for which no telephone number could be found, and miscoded outcomes. The latter category resulted from situations where the CATI file showed that a call had been made but no outcome was recorded by the enumerator corresponding to that call on the written record.

Table 10. z-values for test to compare completion rates by call

Call	Rate	1	2	3	4	5	6	7
Call	Rate	.335	.358	.317	.314	.208	.219	.184
2	.358	-1.31						
3	.317	.90	1.85					
4	.314	.90	1.73	0.12				
5	.208	4.47	5.02	3.58	3.27			
6	.219	3.53	4.06	2.84	2.61	-0.31		
7	.184	3.83	4.27	3.28	3.10	.60	0.81	
8+	.113	8.11	8.55	7.08	6.65	3.28	3.37	2.13

z-values for early versus late comparison

	1	2	3	4	5	6	7
Early rate	.335	.344	.339	.336	.328	.323	.319
Late rate	.290	.253	.220	.176	.162	.135	.113
z-value	3.48	7.15	8.42	9.93	8.86	8.46	7.80

As can be seen from tables 11 and 12, calls made between 6 p.m. and 9 p.m. had a relatively higher probability of being completed whereas calls made between 3 p.m. and 6 p.m. tended to result in a higher probability of a need for a callback. Of calls which resulted in a completed interview, 49.4 percent were initiated in the peak period of 6 p.m. to 9 p.m. Looking at the data in another manner, we see that 39.6 percent of all calls made between 6 p.m. and 7 p.m. resulted in completed interviews (the highest rate), compared with only 20.6 percent of those attempted between 3 p.m. and 4 p.m. (the lowest rate recorded for the 3 p.m. to 9 p.m. operating period).

Table 13 shows the distribution of completed calls by date and hour of the day when the completion occurred. The best days in terms of completion rates were Tuesday, November 19, and Wednesday, November 20, when 34 percent of the completed calls were actually completed. However, this probably reflects the improved efficiency of the enumerators after 4 days of on-the-job experience rather than any other effect. Across the 8-day calling period, 2 hours emerge as the "best:" 6 p.m. to 7 p.m. on the first 2 days and on the 7th day, and 8 p.m. to 9 p.m. on the remaining 5 days of the study. A chi-square contingency table analysis of the 3 p.m. to 9 p.m. operating period showed that there was a significant change in the distribution of completed calls by hour of the day across the survey period (chi-square = 61.5 with 35 df, P = .004). Also, an analysis of variance on the 3 p.m. to 9 p.m. operating period using the method of unweighted means and the arcsine square-root transformation on the percentages showed significant effects due to day, hour, and interaction between day and hour (see App. B).

Most of the calls made during the morning hours resulted from appointments made to callback. For the first 7 days of the study, 18 out of the 24 morning calls were the direct result of

callbacks. Of the remaining six, three of them were made on Tuesday, November 19, between noon and 1 p.m. and were completions recorded on the first attempt to contact the designated operation. On this day, five of the enumerators were working a regular shift starting at noon. On the last day of the study, November 25, two enumerators were working all morning. For this day, 4 out of the 22 morning calls were the direct result of callbacks, whereas the remaining 18 were attempts to clean up those operations which had not yet been resolved.

Table 11. California A & P results by outcome and hour of attempt

Hour	Result of the attempt											
	Busy		Callback		Completed*		Refused		No Answer			
	#	%	#	%	#	%	#	%	#	%		
8- 9			1	0.1	8	0.5						
9-10	1	0.2	3	.3	5	.3				5	0.3	
10-11	2	.4	12	1.2	10	.6				13	.7	
11-12	6	1.2	2	.2	9	.6				12	.6	
12- 1	6	1.2	17	1.8	14	.9	4	5.1		31	1.7	
1- 2	52	10.2	70	7.2	81	5.0	4	5.1		121	6.5	
2- 3	43	8.4	83	8.6	100	6.1	1	1.3		174	9.4	
3- 4	78	15.3	185	19.1	157	9.6	7	9.0		288	15.5	
4- 5	75	14.7	186	19.2	211	12.9	12	15.4		300	16.1	
5- 6	40	7.9	142	14.6	232	14.2	11	14.1		239	12.9	
6- 7	63	12.4	87	9.0	282	17.2	14	17.9		228	12.3	
7- 8	85	16.7	105	10.8	292	17.8	14	17.9		249	13.4	
8- 9	58	11.4	77	7.9	235	14.4	11	14.1		199	10.7	
Total	509	100.0	970	100.0	1,636	100.0	78	100.0		1,859	100.0	

* Total completed is 1,636 since 6 completed responses did not have date and time information.
 4 completed responses were the result of computer problems with CATI.
 2 completed responses were the result of calls returned by the farm operator following a message being left on an answering device.

Table 12. California A & P results by hour of attempt and outcome

Hour	Result of the attempt										Total for all calls*	
	Busy		Callback		Completed		Refused		No answer		#	%
	#	%	#	%	#	%	#	%	#	%		
3- 4	78	10.2	185	24.3	157	20.6	7	0.9	288	37.8	762	100.0
4- 5	75	9.1	186	22.5	211	25.5	12	1.4	300	36.2	828	100.0
5- 6	40	5.7	142	20.1	232	32.9	11	1.6	239	33.9	706	100.0
6- 7	63	8.8	87	12.2	282	39.6	14	2.0	228	32.0	713	100.0
7- 8	85	10.7	105	13.2	292	36.7	14	1.8	249	31.3	795	100.0
8- 9	58	9.5	77	12.6	235	38.4	11	1.8	199	32.5	612	100.0

* Includes problems due to the telephone or no telephone as well as completions, refusals, line busy, callbacks, and no answers.

Table 13. California A & P completion rates by date and time of day*

Hour	Day and date of contact							
	Tues 12		Wed 13		Thurs 14		Mon 18	
	#	%	#	%	#	%	#	%
8- 9			1	100.00	2	100.00		
9-10					2	50.00		
10-11					2	50.00		
11-12								
12- 1								
1- 2							19	33.33
2- 3							20	25.64
3- 4	20	24.39	17	28.33	4	12.50	21	17.80
4- 5	14	31.82	24	22.43	36	33.03	39	34.21
5- 6	26	33.77	34	40.96	35	37.63	34	44.16
6- 7	38	43.68	39	46.99	35	37.23	31	47.69
7- 8	37	38.14	40	40.82	38	35.85	45	54.22
8- 9	21	24.14	35	33.02	44	44.44	38	55.88
Total	156	9.54	190	11.61	198	12.10	247	15.10

Hour	Day and date of contact							
	Tues 19		Wed 20		Thurs 21		Mon 25	
	#	%	#	%	#	%	#	%
8- 9			3	75.00	1	100.00	1	100.00
9-10	2	28.57					1	20.00
10-11	2	40.00	3	42.86			3	10.71
11-12							9	30.00
12- 1	6	20.69					8	18.18
1- 2	15	21.43	20	22.99	16	18.18	11	23.91
2- 3	21	30.00	29	29.29	20	17.86	10	18.52
3- 4	30	24.19	32	24.24	23	15.86	10	14.49
4- 5	37	29.13	32	25.00	20	16.67	9	11.39
5- 6	35	40.70	31	27.93	27	25.23	10	14.89
6- 7	59	47.97	39	36.11	34	32.08	7	14.89
7- 8	49	40.50	45	36.89	32	23.70	6	18.18
8- 9	26	50.00	40	40.00	28	31.46	3	27.27
Total	282	17.24	274	16.75	201	12.29	88	5.38

* Total completed in table is 1,636 since 6 completed responses did not have date and time information. # is the actual number of calls resulting in a completion during this hour of this day.

% is the percentage of those calls made during this hour of this day which resulted in a completion.

4 completed responses were the result of computer problems with CATI.
2 completed responses were the result of calls returned by the farm operator following a message being left on an answering device.

Analysis of Callbacks

The information recorded by the enumerator for the 970 attempts (18.1 percent of all attempts) for which the outcome was recorded as a callback is given in table 14. This data has already been collapsed to some degree as the actual data recorded often included a date and a time interval in which to try to contact the farm operator. As can be seen, most of the callbacks (52.5 percent) were requested for the evening hours (after 5).

Table 14. Distribution of information obtained from respondents when their response was coded as a callback

Information received	Number	Percent
Evening only (after 5)	509	52.5
P.m. or evening (after noon)	218	22.5
P.m. only (noon to 5)	35	3.6
Anytime day (before 5 p.m.)	23	2.4
A.m. only (before noon)	60	6.2
Other information *	64	6.6
No information	61	6.3
Total	970	100.0

* Includes such information as not at home, in and out, hard to catch, does not understand English, answering service, call a different number, etc.

An analysis of the 845 callback outcomes for which some specific time information was recorded as an "appointment" to call back is presented in table 15. In order to generate these data, we note that typical "appointments," after they were converted to military time, could be classified into one of the following four cases:

1. Call at hhmm; for example, call at 0830.
2. Call after hhmm; for example, call after 1800.
3. Call before hhmm; for example, call before 1200.
4. Call between hhmm and iinn; for example, call between 1200 and 1300.

The data used was constructed from the raw data in the following manner:

1. Call at hhmm. Appointment time was coded as hh. In the example given above, we would code 08.
2. Call after hhmm. Appointment time was coded as hh, hh+1, ..., 22. In the example given above, we would code 18, 19, 20, 21, and 22.

3. Call before hhmm. Appointment time was coded as 07, 08, ..., hh if the appointment was for a later date in the survey period. In the example given above, we would code 07, 08, 09, 10, 11, and 12. If the appointment was for later that same day, then the appointment time was coded as HR, HR+1, ..., hh, where HR was the time at which the callback appointment was secured. For example, if our call had been made at 1012, then the example would yield 10, 11, and 12.
4. Call between hhmm and iinn. Appointment time was coded as hh, hh+1, ..., ii. In the example given above, we would code 12 and 13.

Note that each contact which resulted in the outcome callback can result in one or more data records to be used in this table. This resulted in 2,111 data records derived from the 845 usable contacts.

Table 15. Callback "appointment" times for California A & P Survey

Appointment time	Count	Percent	Cumulative percent
7	6	0.3	0.3
8	56	2.7	2.9
9	67	3.2	6.1
10	66	3.1	9.2
11	58	2.7	12.0
12	69	3.3	15.3
13	103	4.9	20.1
14	99	4.7	24.8
15	139	6.6	31.4
16	151	7.2	38.6
17	179	8.5	47.0
18	280	13.3	60.3
19	292	13.8	74.1
20	276	13.1	87.2
21	144	6.8	94.0
22	126	6.0	100.0

Due to the requirements of another research study being conducted (Pafford, 1986) the enumerators were instructed that whenever possible they were to make their own callback attempts. This introduced some bias since there was an attempt to constrain the callback "appointment" into the scheduled working hours for the enumerator making the call. Even with this bias, 52.5 percent of the scheduled "appointments" were in the evening time period (after 5); and the 3-hour period from 6 until 9 was the period requested most often.

Further analysis of the callback data with respect to the outcome gave the following results. The callbacks (if made) were classified as being at the correct time if they were made within some specified interval (fuzz) of the "appointment" time (as defined in case 1 above) or within the "appointment" interval specified

(cases 2, 3, and 4 above) extended by the fuzz amount. Fuzz values of 45, 30, 15, and 10 minutes were chosen and results for them are shown in table 16. Note that the value of fuzz affects only the definitions of "on time" and "wrong time" results, and so only these two callback timings are presented in table 16 for the different values of fuzz. Choice of the fuzz values was arbitrary although current definitions in the CATI scheduler routines use 10 minutes for "hard" callback appointments and 30 minutes for "soft" appointments. In this context, a "hard" appointment is coded when the respondent indicates that the callback should be at a specific time, whereas a "soft" appointment is coded when the respondent indicates an interval of time. Operational definition of "hard" and "soft" for an appointment is a judgement by the enumerator at the time that the appointment information is keyed into the computer.

Table 16. Outcome of callbacks by time and degree of fuzz

Timing of callback (fuzz)	Outcome of callback attempt											
	Complete		Busy		Callback		No answer		Other		Total	
	#	%	#	%	#	%	#	%	#	%	#	%
On time (45)	376	52.5	74	10.3	142	19.8	84	11.7	40	5.6	716	73.8
Wrong time (45)	18	23.7	8	10.5	18	23.7	14	18.4	18	23.7	76	7.8
On time (30)	354	53.1	69	10.3	131	19.6	78	11.7	35	5.3	667	68.8
Wrong time (30)	40	32.0	13	10.4	29	23.2	20	16.0	23	18.4	125	12.9
On time (15)	268	51.9	56	10.9	101	19.6	68	13.2	23	4.5	516	53.2
Wrong time (15)	126	45.6	26	9.4	59	21.4	30	10.9	35	12.7	276	28.5
On time (10)	218	50.0	49	11.2	92	21.1	58	13.3	19	4.4	436	44.9
Wrong time (10)	176	49.4	33	9.3	68	19.1	40	11.2	39	11.0	356	36.7
Wrong day	16	29.1	2	3.6	15	27.3	12	21.8	10	18.2	55	5.7
No data	17	27.0	5	7.9	23	36.5	8	15.9	8	12.7	61	6.3
Total	427	44.0	89	9.2	198	20.4	118	12.2	76	7.8	908	93.6*

* There were 62 callback outcomes (6.4 percent) which were terminated without any further attempt being made to contact the operations. These were typically when the appointment time given was outside the timeframe for the survey.

If the fuzz value is 30 minutes or more, there is a significant difference in the completion rates between "on time" callbacks and calls returned at some other time (wrong time and wrong day calls pooled). For example, with fuzz set at 30 minutes, there were 667 calls which were made "on time," 354 (53.1 percent) of which were completed. Of the 180 calls returned at some other time, only 56 (31.1 percent) were completed. Thus it is better to make callbacks in an interval of less than 30 minutes around the time that the respondent suggests that they should be made rather than at some other time. The successful completion rate for callbacks made at the "appointment" time (53.1 percent) is significantly greater than the completion rate for first contacts (33.5 percent from table 9; z

= 8.86, $P = .00001$). Also, the completion rate for callbacks made other than at the "appointment" time was 31.1 percent, which is not significantly different from the rate for first contacts ($z = 0.65$, $P = .52$).

Analysis of Busy and No Answer Calls

For the 509 calls which resulted in a busy signal and the 1,859 calls which resulted in no answer, the outcome of the immediately following attempt made to contact that operation was examined. There were 4 operations for which the last attempt made was recorded as busy and 79 for which the last attempt made was recorded as no-answer. The remaining 505 busy and 1,780 no-answer data records yielded data for this analysis. For each pair of calls generated in this manner, the time between the calls was computed. This time was determined operationally solely at the convenience of the enumerator, but any guidance which can be obtained from this analysis may prove useful in the design of an automatic scheduler for the CATI system. Table 17 shows a summary of the data obtained in this analysis.

If the outcome of a call is a no-answer, then the best time to call back seems to be 4 to 5 hours later, with a reasonably good time period for obtaining a completed call being between 2 and 6 hours after the initial call which gave a no-answer response. If a callback is made within 2 hours, there tends to be a greater than 60 percent chance that another no-answer will be its outcome.

Some caution should be used in interpreting these results, however, since larger values of time between calls are highly related to the time of the day when the call was made, a variable which has already been demonstrated to have a significant effect upon the probability of obtaining a completed response. In this study, of the 27 calls which were completed between 4 and 6 hours following a no-answer call, all but 1 was completed after 5 p.m. and all were the result of followup calls to no-answer responses obtained between 10 a.m. and 4 p.m. of that same day. In a similar manner, the 52 calls completed between 2 and 4 hours following a no-answer call were all completed after 4 p.m. (47 of them after 5) and were the result of followup calls to no-answer responses obtained between 1 p.m. and 6 p.m. of that same day.

If the outcome to the call is a busy signal, then the best time to callback seems to be 15 to 29 minutes later, with a secondary time period 1 to 4 hours later. Callbacks in less than 15 minutes were not very productive, and 39.3 percent of them resulted in another busy signal.

Table 17. Outcomes of calls following busy and no answer calls by times between calls.

Time between calls	Variable	Outcome of initial call							
		Busy				No answer			
		Busy	Call back	Complete	No answer	Busy	Call back	Complete	No answer
0-14 mins	Count	35	15	16	17	6	4	4	57
	Percent*	39.3	16.9	18.0	19.1	6.7	4.4	4.4	63.3
15-29 mins	Count	16	13	36	9	7	4	11	118
	Percent*	20.6	16.9	46.8	11.7	4.8	2.7	7.5	80.3
30-44 mins	Count	15	12	21	13	5	12	24	103
	Percent*	23.1	18.5	31.5	31.5	3.3	8.0	16.0	68.7
45-59 mins	Count	5	8	17	17	4	8	21	117
	Percent*	9.3	14.8	31.5	31.5	2.6	5.2	13.6	76.0
1-2 hrs	Count	10	13	26	11	12	31	56	207
	Percent*	16.1	21.0	41.9	17.7	3.7	9.6	17.3	64.1
2-3 hrs	Count	2	4	15	11	11	16	34	52
	Percent*	5.6	11.1	41.7	30.6	9.4	13.7	29.1	44.4
3-4 hrs	Count	1	2	5	4	2	8	18	25
	Percent*	8.3	16.7	41.7	33.3	3.6	14.3	32.1	44.6
4-5 hrs	Count	0	0	0	1	1	2	16	11
	Percent*	0	0	0	100.0	3.0	6.1	48.5	33.3
5-6 hrs	Count	0	0	4	0	5	3	11	9
	Percent*	0	0	100.0	0	16.1	9.7	35.5	29.0
6 hours or more	Count	8	23	29	40	53	131	149	325
	Percent*	7.6	21.9	27.6	38.1	7.8	19.3	21.9	47.9
Total	Count	92	90	169	123	106	219	344	1,024
	Percent*	18.2	17.8	33.5	24.4	6.0	12.3	19.3	57.5

* Percentages do not add to 100 due to calls which had refusal, telephone noise, no telephone available, or other as the coded outcome. These outcomes did not occur frequently enough for analysis.

Effect of Size of Operation

An attempt was made to examine the effect of the size of the farming operation upon the response rate. This analysis was conducted using only the outcomes for the first call made to each operation, thus simulating a random sample. Two dichotomous dependent variables were constructed, one taking the value one whenever a completion was recorded from the farm operator, and the other taking the value one for a completion by the farm operator, the spouse, or any other knowledgeable individual. The surrogate for the size of the operation which was used was the land in farm value which was categorized into five groups as follows: Less than 40 acres, 40 to less than 80 acres, 80 to less than 160 acres, 160 to less than 640 acres, and greater than 640 acres. A multiple linear regression was conducted for each variable with hour of the day and the surrogate variable for size as the independent variables. Since the dependent variable takes only the values zero or one, this regression analysis can be considered as a form of

discriminant analysis.

For both of the dependent variables, I was found that the hour of the day had a significant effect and that the surrogate variable for size of the operation was significant when all responses were considered but was not significant when only responses by the operator were considered. These results are summarized in Appendix C.

This analysis confirms the previous analysis showing that the evening hours (after 5) to be the best time for achieving a completed response. In addition, there is an indication that operations in the 40- to 80-acre size range are more likely to result in a completed response than operations of any other size category.

Conclusions and Recommendations

The analyses conducted confirm the usual adage that the evening is the best time of the day to obtain completed telephone interviews when sampling. In this study, the hour from 6 to 7 was the best overall period, with 8 to 9 coming in a close second. The relative ranking of these 2 hours varied from day to day during the survey period, with 8 to 9 being the best time period on 5 of the 8 days of the survey. In addition, the analysis of callback data indicates a strong preference for contacts to be made between 6 and 9. No analysis of the data was made by day of the week due to the lack of consistency in the operators' working assignments from day to day.

Throughout the analyses conducted on time of contact, as the completion rate increased, the proportion of calls recorded as callbacks and no-answers decreased while the proportion of calls for which busy or refusal was coded as the outcome remained relatively constant. The trend observed across number of attempts made to contact the operation was for the completion rate and the callback rate to decrease and the no-answer rate to increase, while the rates for other outcomes remained relatively constant.

I recommend that telephone interviewing should be scheduled for the evening hours (6 to 9) wherever feasible. Some provision must still be made for morning and afternoon contacts, and non prime time calling may still be necessary in order to achieve the desired response rates within the limited time period allowed to conduct the survey in question. Even with a lower completion rate per call, a telephone interview is still considerably cheaper than a personal interview.

Every effort should be made to follow up on a callback within an interval of no more than 30 minutes on either side of the time stated by the respondent who provided the "appointment" information. In the event that a call results in a busy signal, I recommend that a followup call be made between 15 and 30 minutes later. In the event that a call results in a no-answer, indications are not as clear. However, I recommend that callbacks should be made no

earlier than 2 hours following the call which resulted in no answer.

Further study of this topic is needed since this study reflects one State (California) in 1 month (November, 1985) and for one survey (Acreage & Production). In addition, the sample was specifically selected to contain small grain operators. I plan to collect CATI data from the April ISP in three States (California, Georgia and Nebraska) for similar analysis.

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Appendix table 1. Strata definitions, population, June Survey and study sample sizes

Stratum Use	Orig	Description	Pop. Size	June Sample	Small Grains	Sample Size
	1	Small F.C., No M.C., No G.S.	9,268	3,543		
1	2	Small F.C., Sig M.C. or small grains	144	83	658	640
	3	Small F.C., Large G.S.	5	4		
2	4	F.C. 100-999, No M.C., No G.S.	4,271	1,644	697	640
	5	F.C. 100-999, Sig M.C. or small grains	755	435		
	6	F.C. 100-999, Large G.S.	128	87		
	7	F.C. 1000-7999, No M.C., No G.S.	595	267		
	8	F.C. 1000-7999, Sig M.C. or small G.S.	293	173		
3	9	F.C. 1000-7999, Large G.S.	122	99	727	640
	10	Extreme livestock without M.C. or G.S.	136	11		
	11	Extreme livestock, Sig M.C. or G.S.	21	6		
	12	Extreme livestock, Large G.S.	7	7		
	13	Extreme G.S.	33	28		
	14	Extreme field crops	36	35		
TOTAL			15,814	6,423	2,082	1,920

F.C. designates field crops
M.C. designates miscellaneous crops
G.S. designates grain stocks

Sampling for the 1985 June Acreage survey consisted of 2,006 samples drawn for probability estimation purposes, supplemented with the remaining operations in the universe, 13,808, for nonprobability estimation purposes, thus giving a total population of 15,814. The total response to the June Acreage survey was 6,424 of which 2,082 reported either durum wheat, other wheat, barley, or oats (small grains) acreage. The original universe was stratified into the 14 strata listed above, but these were combined for research purposes into the three strata which can be designated as small, medium, and large operations. A random sample of 640 was then selected from each of these strata. For more details of the study, see Pafford (1986).

Appendix table 2. Analysis of variance table for transformed completion rates

Source	df	SS	MS
Dates	7	25.146	3.592
Hours	5	20.052	4.010
H x D	35	10.952	0.313
Within	1361	12.000	0.009

Appendix table 3. Table of means of transformed data by date

Date							
12	13	14	18	19	20	21	25
0.6062	0.6349	0.6103	0.7036	0.6694	0.5962	0.5104	0.4195

Appendix table 4. Table of means of transformed data by hour

Hour					
15	16	17	18	19	20
0.4630	0.5235	0.6091	0.6630	0.6400	0.6643

Appendix table 5. Analysis of variance table for completion by operator variable

Source	df	SS	MS	F	P
Hour	7	15.766	2.252	10.70	0.0001
Size	4	1.468	0.367	1.74	.1376
Error	1591	334.782	.210		

Note that only 1,603 of the 1,920 operations could be used in the analysis due to missing values of the variable land in farm.

Appendix table 6. Analysis of variance table for completion by anyone variable

Source	df	SS	MS	F	P
Hour	7	13.210	1.887	8.27	0.0001
Size	4	4.112	1.028	4.50	.0013
Error	1591	363.234	.228		

Appendix table 7. Means of completion variables by hour and size of operation

Hour	Variable	Size of operation					Total
		1-40 acres	40-80 acres	80-160 acres	160-640 acres	640 + acres	
	n	13	10	15	43	45	126
13	All	0.308	0.300	0.267	0.209	0.267	0.254
	Operator	.154	.200	.267	.186	.267	.222
	n	13	9	28	40	34	124
14	All	.231	.222	.286	.225	.412	.290
	Operator	.231	.222	.179	.125	.294	.202
	n	25	18	28	83	105	259
15	All	.240	.389	.357	.277	.200	.259
	Operator	.080	.222	.250	.241	.152	.189
	n	18	16	30	83	108	255
16	All	.556	.625	.400	.349	.314	.373
	Operator	.444	.375	.300	.253	.250	.278
	n	15	12	28	85	96	236
17	All	.600	.750	.464	.435	.417	.458
	Operator	.333	.667	.286	.435	.385	.403
	n	18	11	25	54	80	188
18	All	.389	.545	.480	.537	.462	.484
	Operator	.333	.455	.400	.481	.438	.436
	n	15	19	18	91	79	222
19	All	.600	.684	.556	.495	.354	.473
	Operator	.533	.526	.556	.440	.354	.432
	n	19	25	20	53	76	193
20	All	.263	.640	.450	.434	.447	.451
	Operator	.263	.560	.350	.415	.368	.394
	n	136	120	192	532	623	1,603
Total	All	.390	.550	.406	.383	.353	.387
	Operator	.287	.425	.313	.336	.310	.326