How to calculate the NCPi performance measure

Note : This is part of an article submitted to Quality and Quantity, accepted but not yet published. The NCPi is an index of the Net Contribution to Performance in telephone surveys calculated for each interviewer and shift. The former name of this index was WUPI, which stands for Weighted Unbiased Performance Index.

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Three steps must be performed in order to compute the performance index. First, each call has to be characterized to determine its status; second, the measures of each interviewer's daily work load have to be computed; and finally, the daily performance index is computed.

Step 1: characterize each call

Every call made may be characterized in terms of both its result and its initial state. Specifically, the information needed is whether the call is a first contact to a given phone number (fresh sample or previous "ring no answer"), whether the call is made because of an appointment taken with the household, or whether the call is to a household where someone had previously refused to cooperate. To gather this information, it is necessary to sort the administrative dataset by telephone number and then by call sequence (date and time of each call).[1] Then, using the lag function, it is possible to retrieve the previous result obtained by a call to a given phone number . A special code is attributed to the lag result when there is no lag, i.e., when the call is the first for a given phone number. Disposition codes may be recoded into a reduced number of important codes (completed, appointments, ring no answer, refusals, out of sample).

[1] This assumes that the survey is conducted using a CATI system that automatically produces a file of call results which includes time of day, date of call, length of call, interviewer identification, and call result, as is the case with most available CATI software.

After computing the lag variable, each line in the dataset contains, for each call, the current disposition code as well as the code of the previous call made to the same number. This allows the computation of a variable that characterizes the task performed each time a number is dialed. The new variable may be computed by adding the code of the current call to the product of the lagged code and 100. This gives a four-digit code in which the two first digits refer to the result of the previous call and the two last digits, to the current call result. If the code for a never-reached phone number is 10 and the code for a completed questionnaire is 1, a code of 1001 characterizes a completed questionnaire from a never previously reached phone number. Similarly, a call resulting in a completed interview can be categorized as completed from an appointment or completed from a previous refusal; and a refusal can be categorized as a refusal from a never-reached phone number, a second refusal, or a refusal from an appointment.

The only additional information needed at this step is the mean length of a completed questionnaire. This information can be obtained either by temporarily selecting the records of completed interviews and calculating the average time or by using a “means by disposition code” type of analysis. The new variable mean time is added to the file afterward and is used to compute an index that takes into account questionnaire length and that is therefore comparable across projects.

The administrative database now has the following information for each call: interviewer identification; date, time of day, and duration of the call; disposition code of the call; disposition code of the preceding call for the same phone number (or a special code if the call is the first attempt); and the task variable, which combines the previous and current disposition codes and the mean interview length for completed calls.

A sample file is presented in Table 4.

Table 4. Result of Step 1 (first 12 observations in the file - administrative base)

Line No.	Quest. No.	Interviewer's Initials	Date of Call (yr, mth, day)	Day of the Week	Time of Call	Duration of Call (seconds)	Total n. of Calls for Number	Disp. Code	Recoded Disp. Code	Recoded Previous call	Task	Mean Interv. Duration
1	1	SDD	20001025	4	1507	22	8	10	10	20	2010	1661
2	1	DAB	20001025	4	1755	5	8	11	10	10	1010	1661
3	1	KBB	20001026	5	1751	36	8	10	10	10	1010	1661
4	1	ACC	20001028	7	1156	5	8	10	10	10	1010	1661
5	1	EVS	20001029	1	1412	21	8	10	10	10	1010	1661
6	1	DDF	20001030	2	1021	56	8	7	7	10	1007	1661
7	1	CLL	20001102	5	1236	16	8	7	7	7	707	1661
8	1	ELL	20001103	6	1417	36	8	7	7	7	707	1661
9	2	DDF	20001025	4	1506	1850	1	1	1	20	2001	1661
10	3	SDD	20001025	4	1508	1381	1	1	1	20	2001	1661
11	4	DDF	20001025	4	1542	24	5	10	10	20	2010	1661
12	4	DAB	20001025	4	2026	75	5	13	12	10	1012	1661

In Table 4, the first eight lines provide the information gathered for calls made to the phone number of questionnaire no. 1. For example, line 1 shows that interviewer SDD called the phone number on October 25 (20001025) at 3:07 P.M. (1507). The call lasted 22 seconds. Nobody answered the call (code 10), and since it was the first call to this phone number, the resulting code for the task performed is 2010, i.e., no answer from a fresh sample. The four subsequent calls to this phone number resulted in either a no answer or a busy signal (code 11), and therefore the task performed is coded 1010 (no answer from a previous no answer). Line 6 shows that a refusal (code 7) was recorded on October 30 (code 1007). Task code 707 on lines 7 and 8 indicate that subsequent attempts to

contact the household also resulted in no answers and thus remained coded as first refusals. This, however, would depend on the coding scheme adopted by the firm. Had a second refusal occurred, a different code would have been used. Line 9 shows that DDF completed a questionnaire on the first call to the phone number for questionnaire no. 2. It resulted in a task code of 2001, i.e., completed from a fresh sample. The last column gives the mean interview duration in seconds.

Step 2: generate information on the daily work load of interviewers

The second step consists in producing the measures necessary to determine each interviewer's daily work load. The dataset must be re-sorted, this time by interviewer and then by date and time of call. This sorted file can then be aggregated by interviewer and date in order to produce a file in which the daily work load for each interviewer can be computed. Using aggregation by interviewer and by day, it is possible, for each interviewer-day, to calculate the total number of calls, the proportion and number of completed interviews obtained from never-reached phone numbers, previous appointments, or previous refusals as well as the proportion and number of refusals from never-reached phone numbers. Two characteristics of the interviewer's shift can also be generated: a) shift duration, calculated by subtracting the time of the first call from the time of the last call and adding the length of the last call; and b) the time "on call," calculated adding up the duration of all calls. The aggregated file now contains all the information necessary to characterize each interviewer's daily work load and performance. One could also add a variable giving the experience of the interviewer on a given project in order to analyze the impact of experience. Any relevant information on each interviewer may be added at this step: previous experience, answers to a questionnaire on attitudes and behavior, gender, etc.

Table 5 shows an example of the content of the file at this step.

Table 5. Result of Step 2 (file sorted by interviewer, date, and time of call)

Line no.	Interviewer's Initials	Date of Call	Time of Call	Duration of Call (in seconds)	Disposition Code	Recoded Disp. Code	Recoded Code - Previous Call	Task
1	AAC	20001121	1327	51	10	10	20	2010
2	AAC	20001121	1328	1584	1	1	12	1201
3	AAC	20001121	1355	148	14	12	12	1212
4	AAC	20001121	1358	8	12	12	12	1212
5	AAC	20001121	1359	6	21	2	10	1002
6	AAC	20001121	1359	66	13	12	12	1212
7	AAC	20001121	1400	34	13	12	12	1212
8	AAC	20001121	1401	87	13	12	12	1212
9	AAC	20001121	1402	1481	1	1	12	1201
10	AAC	20001121	1434	69	13	12	12	1212
11	AAC	20001121	1435	41	13	12	12	1212
12	AAC	20001121	1436	84	13	12	12	1212

Note: In Step 2, the file is sorted by interviewer, date, and time of call. The table shows the first 12 calls made by AAC from 1:27 p.m. to 2:36 p.m., AAC completed two questionnaires. A call at 1:28 P.M. (line no. 2: 1328) resulted in an interview that lasted 1584 seconds, and another at 2:02 (line no.9) lasted 1481 seconds. Both were completed from appointments (disp. code 12, task code 1201).

Step3: calculate the performance index

The final step consists in calculating the performance index. First, the maximum number of completed interviews during a given shift must be obtained (shift duration divided by the average length of a completed interview). Then the interviewer's performance during a given shift – the raw index -- is computed by adding the number of completed interviews from first contact and from appointments, subtracting the number of refusals, and adding twice the number of completed interviews from refusals. The ratio of the raw index over the maximum number of completed interviews—the maximum performance index—gives the Weighed Unbiased Performance Index, or NCPi, for each day of work. Table 6 shows part of the information that appears in the resulting file.

Table 6

File Aggregated by Interviewer and Shift

Line no.	Interv.'s Initials	Date	Time Started	Time Last Call	Dura-tion Last Call	Length of Shift (hours)	No. Interv. per Hour	Days on Pro-ject	Time on Phone per Shift	% of Time on Phone	COOPR T1	NCPi	Propor-tion of Ring no Answer Called	Proport. Of fresh sample	Prop. of First Refu-sals	Prop. of Com-pleted From Fresh Sample	Prop. of Com-pleted From Ring no Answer	Prop. of Refusal Conversion
1	AAC	20001121	1327	2058	31	8:03	.75	1	5:58	69.47	.70	.34	.232	.268	.000	.071	.054	.000
2	AAC	20001122	1308	2108	19	8:32	.60	2	5:66	68.10	.50	.28	.494	.000	.000	.000	.056	.000
3	AAC	20001123	1307	2103	0	7:93	.63	3	5:72	72.06	.54	.29	.448	.322	.000	.046	.034	.000
4	ABB	20001102	1710	2125	0	4:25	.24	2	2:88	67.86	.25	.11	.547	.203	.016	.016	.016	.000
5	ABB	20001106	1710	2121	0	4:18	.00	3	2:85	68.05	.25	.00	.362	.043	.234	.000	.011	.000
6	ABB	20001107	1724	2125	0	4:02	.50	4	3:17	78.99	.50	.23	.412	.000	.275	.000	.039	.000
7	ABB	20001108	1707	2117	0	4:17	1.20	5	2:99	71.72	1.00	.55	.400	.000	.036	.000	.018	.000
8	ABB	20001109	1711	2128	0	4:28	.23	6	2:30	53.73	.40	.11	.485	.000	.206	.000	.029	.000
9	ABB	20001111	1006	1750	0	7:73	.65	7	4:16	53.75	.33	.30	.192	.144	.184	.008	.000	.016
10	ABB	20001114	1704	2128	0	4:40	.68	8	2:53	57.60	.17	.31	.514	.000	.027	.000	.014	.000
11	ABB	20001115	1724	2104	22	4:03	.25	9	2:57	63.71	.43	.11	.188	.078	.297	.000	.047	.000
12	ABB	20001118	1008	1756	0	7:80	.90	10	4:49	57.51	.27	.41	.053	.283	.342	.026	.000	.000

Note: Table 6 shows part of the information in the file after Step 3 for the first 12 lines. For each interviewer-day, the information shown comprises: time of first call together with time and duration of last call, which allows the length of the shift to be calculated; number of interviews per hour; experience on the project in days; time spent calling during the shift (aggregated sum of call duration per day) and consequently. the

percentage of time spent on the phone; the cooperation rate and NCPi indices; and a number of indicators of the task performed such as the proportion of previous ring no answer called, the proportion of first refusals (attempts at conversion), the proportion of first refusals, and the proportion of completed interviews from fresh sample, previous ring no answer, and refusals. Note that the first day for interviewer ABB in the file is day 2 (line 4 in the column “Days on Project”). This is explained by the fact that on hisfirst day on the project, this interviewer received training and therefore worked less than two hours making phone calls. The information for that day was thus removed from the file because the measure of performance was considered unreliable.

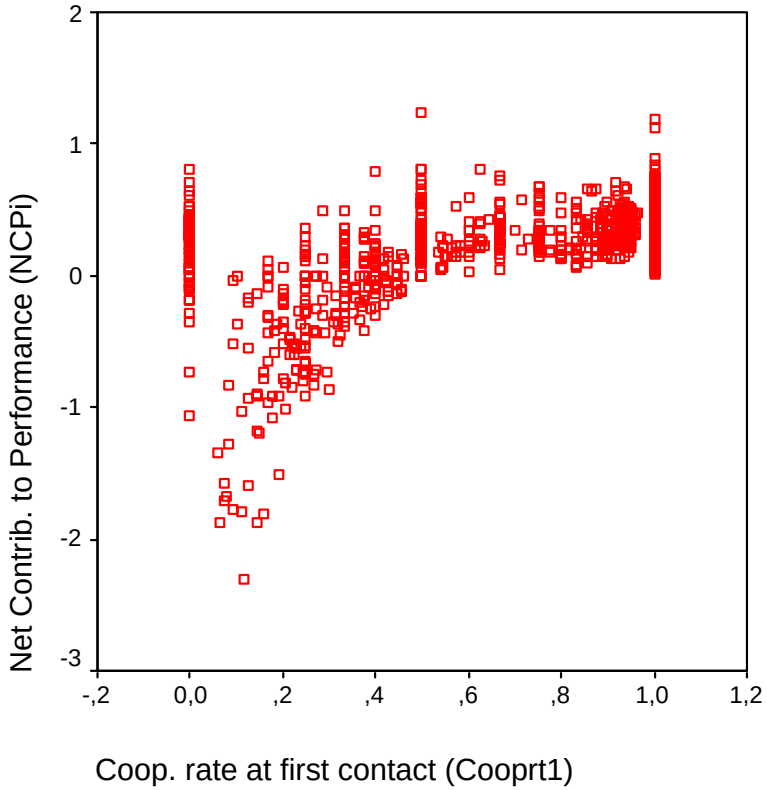

Figure 1. Relationship between NCPi and COOPRT1 for the three projects.