Oliver Lipps

Contact time optimization in panel surveys

Lausanne, March 2010

FORS Working Papers 2010-2

FORS Working Paper series

The FORS Working Paper series presents findings related to survey research, focusing on methodological aspects of survey research or substantive research. Manuscripts submitted are papers that represent work-in-progress. This series is intended to provide an early and relatively fast means of publication prior to further development of the work. A revised version might be requested from the author directly.

Further information on the FORS Working Paper Series can be found on www.fors.unil.ch.

How to cite this document:
Lipps, O. (2010). Contact time optimization in panel surveys. *FORS Working Paper Series,* paper 2010-2. Lausanne: FORS.

Acknowledgements
This study has been realized using the data collected by the Swiss Household Panel (SHP), which is based at the Swiss Centre of Expertise in the Social Sciences FORS. The project is financed by the Swiss National Science Foundation.

ISSN 1663-523x (online)

FORS
c/o University of Lausanne, Vidy
1015 Lausanne
Switzerland
E-mail: paperseries@fors.unil.ch

Summary

In the face of declining contact and response rates and with increasing costs of conducting surveys, many survey agencies resort to implementing contact strategies. As for obtaining contact in panel surveys as early as possible, without annoying people by calling at undesired times and ultimately causing a refusal, this means to implement call time strategies other than randomization of calls to individual households. In this research, we use call data from the Swiss Household panel, a centralized CATI panel survey with a randomized (experimental) call-household assignment. Using random effects models, we analyze efficiencies of obtaining initial contact by assigning optimal times to first calls, and times and spacing to second and later calls, depending on household socio-demography and prior call patterns. We conclude by giving some recommendations that may help to making early and successful contact during fieldwork.

Keywords: call data, paradata, CATI, calling time, call scheduler, random assignment

Contact Time Optimization in Panel Surveys

Oliver Lipps[1]

1. Introduction

Much of the literature for both in-person surveys (e.g., Groves and Couper 1998; Purdon et al. 1999; Lipps and Benson 2005) and telephone surveys (e.g., Weeks, Kulka and Pierson 1987; Greenberg and Stokes 1990, Bricks et al. 1996) points to net efficiencies associated with obtaining initial contact by optimizing interviewer call effort. Purdon et al (1999) conclude that for an improved timing and spacing of calls, there are three dimensions:

- Adjusting the time of day and the weekday
- Deciding the number of times a household is called before deeming it as a noncontact
- Deciding the time between subsequent calls at the same household

The data generally show that attempts made on working day evenings are most likely to yield successful contact with a household member (D'Arrigo 2009, Groves et al. 2004, Kulka and Weeks 1988). Also if the first call was a noncontact, then the optimal time for the second call still appears to be a weekday evening, irrespective of when the first call has been made (D'Arrigo 2009, Purdon et al. 1999, Weeks et al. 1987). The relative efficiency of weekday evenings is reversed somewhat for second as opposed to first calls when the prior calls were also made during these times (Weeks et al. 1987). Purdon et al. (1999) also consider the outcome of the first *contact* – refusal, appointment, or interview. They find little variation in the refusal rate by time of first contact. However householders tend to give an immediate interview if contact is made in the daytime rather than in the evening. An appointment is more often agreed if contact is made in the evening. On the latter issue, Lipps and Benson (2005), rather than investigating the outcome of the *current* contact, analyze the *ultimate* household decision to participate or not. They report that if people are *first* contacted at Sunday and Saturday morning and partially Sunday evening by face-to-face (f2f) appear to generate an annoyance factor that leads to a decreased willingness of respondents to

[1] FORS, c/o University of Lausanne, Bâtiment Vidy, CH – 1015 Lausanne
oliver.lipps@fors.unil.ch

ultimately participate. This means that a refusal might be expressed at a later contact and not necessarily at the first contact. Since the purpose of the contact is the sample member's participation, we believe that the ultimate survey status is more important than that after the first contact.

Dennis et al. (1999) had good experiences in a large random digit dialing (RDD) survey with a CATI call scheduler that assigns calling daytimes and days of the week according to *aggregated* socio-demographic information from the census. It is surprising that only very recently, D'Arrigo et al. (2009) use socio-demographic information of *individual* sample members available from census data to schedule call patterns that control for household characteristics and prior call information. Using call data from six different UK f2f surveys, they confirm previous findings about the higher probability to contact households with children, especially on weekday afternoons and evenings. Households without children are least likely to be contacted on weekdays during the day, whereas weekday evenings are better times. Households without employed persons can be better contacted on weekday mornings or afternoons. Especially in households with a pensioner present to call during the week is promising, comparatively not so at the weekend. The more members a household has, the easier it is to establish contact with the household. Once controlled for household characteristics, D'Arrigo et al. (2009) find no type of area effect on contact probability. Finally, they conclude that varying the timing of subsequent calls in case of a noncontact increases the likelihood to finding someone at home. Generally evenings and weekend calls are reliably good times to call. Leaving a few days between calls increases the probability of contact compared to returning on the same day.

In panel surveys in waves after the first wave, information is not only available on the socio-demography of the households, but also on their contacting properties from previous waves. Both could be used for call schedulers to better planning calling times, especially in telephone panel surveys. There may be efficiencies especially concerning the timing of the first call, but also for subsequent calls. In this research, we primarily aim to analyze first and later calls with respect to an optimal time/household assignment in household CATI panel surveys. In the paper, we analyze the following research questions:

- What are the best times of the day to establish contacts with certain household types? Is it a good idea to call on Saturdays? Do calls at these "best" times that lead to a first contact differ in ultimate *cooperation* behavior?
- If the first call does not lead to a contact, what are the best strategies for subsequent calls?
- To what extent do individual household specific properties and their prior call patterns play a role in terms of (ultimately successful) contactability?
- To what degree can the specifics of panel data be utilized?

The paper is organized as follows: first we present the data and the variables used in the models, such as socio-demography, calling times, their interactions, and prior contact patterns. Next we analyze first calls with respect to calling times that most likely lead to a contact, using a 2-level random effects model. The same model is used to check if certain times may annoy households when they are first contacted at these

times, with respect to their ultimate cooperation behavior. Then we turn to later calls in case the household was not contacted at the first call, using a 3-level model. We discuss the results and give some recommendations for fieldwork at last.

2. Data

We use call[2] data from the Swiss Household Panel (SHP), a nationwide, yearly conducted, centralized CATI panel survey. The advantage to use the SHP is that calls on households are randomized, both within and between waves. The reason is to be as flexible as possible, given continuously changing number, working shifts, and quality of interviewers, and call-back times. Once an interviewer is free, the next still unworked number pops up on the screen to be dialed. Such completely randomized calling times are virtually impossible in f2f surveys, and more so in f2f panel surveys. This makes the SHP an excellent data source to investigate optimal calling times under experimental conditions.

The SHP started in 1999 with slightly more than 5,000 randomly selected households, representative of the Swiss residential population. In 2004, the SHP recruited a refreshment sample, also randomly selected. In each year, first the household composition together with the basic socio-demography of all household members is asked of the household reference person in the grid questionnaire. Preferably, the household reference person should be the same individual across waves. If, however, the previous year's reference person is not available, another adult person in the household who is knowledgeable enough about the household can replace him/her. It takes three to ten minutes to complete the grid questionnaire. After the grid, a household related questionnaire is to be completed (about 10 minutes), again by the reference person. After the household related information is given, each household member from the age of 14 years on is eligible to complete his/her own individual questionnaire (about 35 minutes).

We restrict our analysis to contactability of households during the first step, i.e. completion of the grid questionnaire. Each year, after the regular fieldwork phase is finalized, households that refuse to answer the grid questionnaire are re-approached during the refusal conversion phase unless the centre's[3] survey manager considers re-contacting to be hopeless. The number of calls on a household is in principle not limited, but it is at the discretion of each centre's survey manager to decide not to make further attempts to contact a household. Some households remain "unworked" in the sense that either they cannot be contacted or that an appointment is still pending. In this research we use call data from both the original and the refreshment sample during both survey phases, between the 2005 and the 2009 waves.

---

[2] The term "call" is used for any contact attempt, whether someone was contacted or not (Stoop 2005, p. 139).

[3] The fieldwork for the SHP is conducted from two centres: Berne, mainly responsible for the Swiss-German speaking area, and Lausanne, mainly responsible for the French and Italian speaking parts of Switzerland.

Since we are interested in the household contactability, we use only calls until the first contact, or – if contact cannot be established – all calls on the household level. We impute characteristics of households from which no information is available in the wave under consideration from previous waves, starting with the most recent wave. If for example the household size is missing in 2005, it is imputed from the information in 2004, if available, and so on. The household sample size used amounts to 5,388 in 2005, 5,700 in 2006, 5,945 in 2007, 5,463 in 2008, and 5,564 in 2009. Households have been called up to 467 (!) times until the first contact; the total number of calls is 180,484. In Figure 1, we depict the contact success rate by number of call on a household until the 50th call. Not surprisingly the contact rate is almost monotonously decreasing, but remains above 1% throughout.

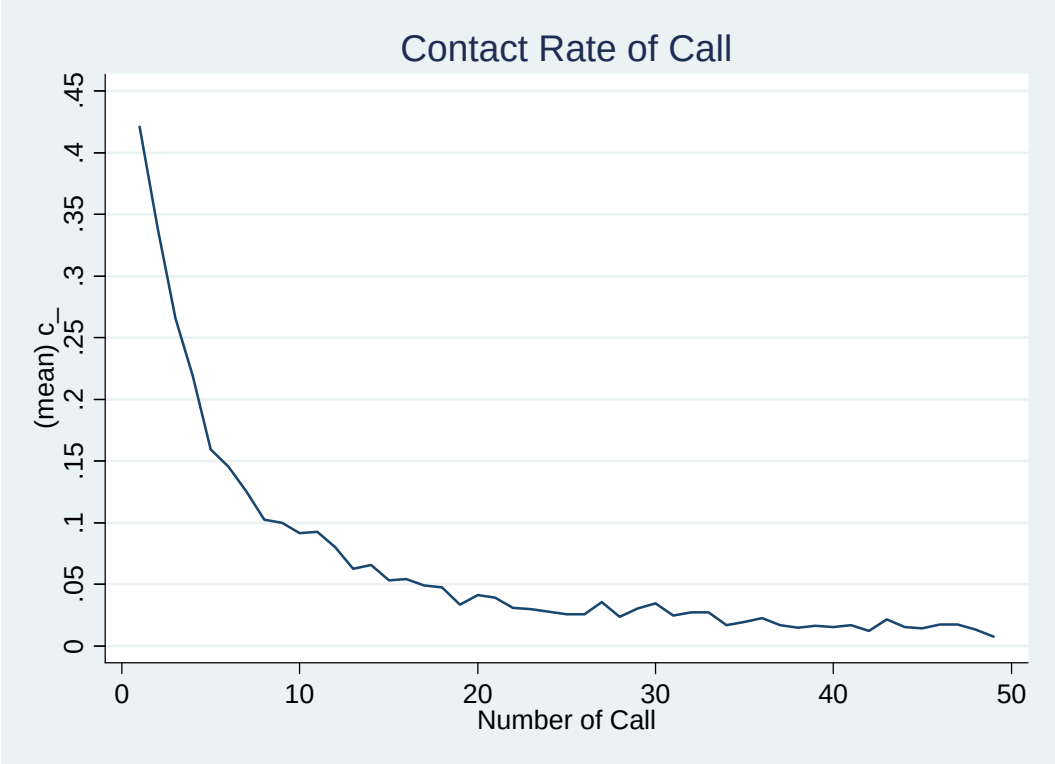

Figure 1 : Contact Rate by Call Number on Household (<50). Data: SHP Call Data 2005-2009

We use the following time windows:

- Weekday morning (8 am – 12:59 pm)
- Weekday early afternoon (1 pm – 4:59 pm)
- Weekday late afternoon (5 pm – 6:59 pm)
- Weekday evening (7 pm – 9:59 pm)
- Saturday (8 am - 12:59 pm)

and the following socio-demographic household characteristics (D'Arrigo et al. 2009):

- Number of persons in the household (1.2.3+)
- Presence of any children under the age of 16 in the household
- Presence of any pensioners or unemployed people in the household

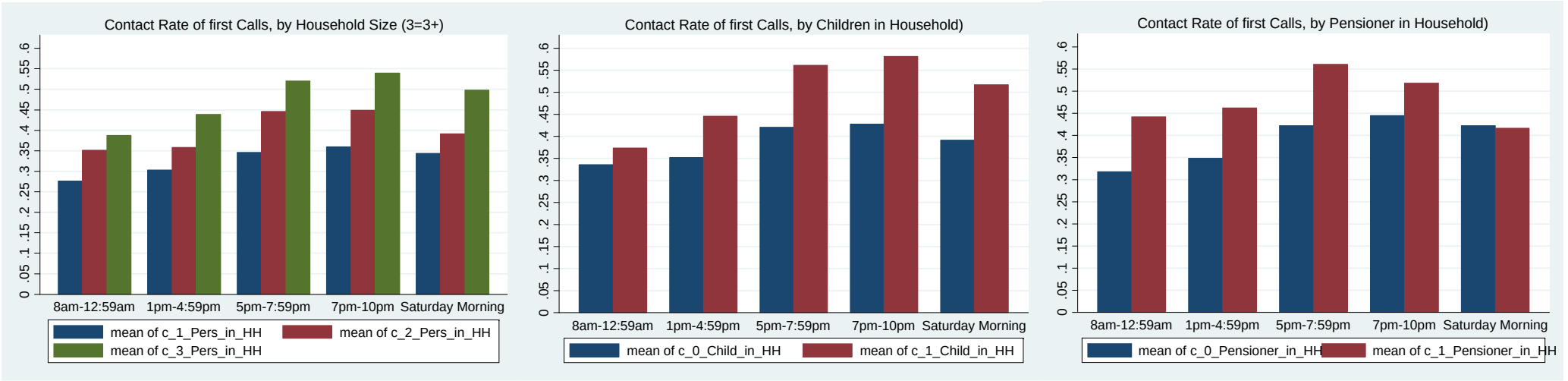

Figure 2 : Mean Contact Rates of first Calls over Weekday Times, and Saturday (only Mornings), by Household Characteristics. Data: SHP Call Data 2005-2009

Distinguished by these household characteristics, the mean contact rate of *first* calls is depicted in Figure 2. Accessibility is the higher the larger the household is (left panel) and the later the call in the course of the day across weekdays (middle panel). Saturday mornings appear to be more preferable than weekday mornings but worse than weekday evenings. A child or a pensioner present in the household (middle and right panel) also increases the chance to contact someone over the phone, irrespective of the daytime. While however weekday mornings seem to work comparatively well in households without children, Saturdays seem to be a good choice for households without pensioners.

We model possible efficiency gains in the next chapter using a multivariate model

3. Modeling

3.1. First Calls

We model the binary variable “obtaining contact”, using a random effects (2-level) logit model with waves as the first, and households as the second level. We test contact efficiency on pair wise combinations of the following variables

- household socio-demography (see above)
- time of day
- day of the week (Monday-Friday or Saturday)

Specifically, we enter the following variables into a backward selection regression (removal level: .01), to test for entry into the 2-level model:

- (time of day) X (household size)
- (time of day) X (child present)
- (time of day) X (pensioner present)
- (day of the week) X (household size)
- (day of the week) X (child present)
- (day of the week) X (pensioner present)
- (time of day) X (day of the week)
- all main effects
- the control variables wave (1-5: linear), original sample (vs. refreshment from 2004, binary), refusal conversion phase (vs. not, binary) and “Swiss German speaking” (vs. French/Italian, binary)
- if the call time window coincides with the time of day at which the household was first contacted in the previous wave (set to 0 if no previous wave available)

The backward logistic regression removes all interaction variables with the exception of:

- (Weekday evening) X (retired person in household)
- (Saturday) X (retired person in household)
- (Weekday early afternoon) X (child present)
- (Weekday late afternoon) X (child present)
- (Weekday evening) X (child present)

The main effects are kept, with the exception of wave and sample.

Altogether, these variables explain only 3.7% (pseudo R2) of the variance to successfully contact a household. In the 2-level random effects model, all variables that result from the backwise regression are still significant on the 1% level, with the exception of the time “Weekday early afternoon” (23%), and the interactions (Saturday) X (retired person in household) and (Weekday early afternoon) X (child present). We drop the insignificant variables from the final 2-level model. The resulting coefficients (odds ratios) together with their z-values, and the within-household standard deviation are depicted in *Table 1*. Interestingly, the within household variance portion (10.0%; standard error=.8%) is almost three times as high as the explained variance from the independent variables in the 1-level regression model (3.7%). This shows the importance to control for the household specific effects (unobserved heterogeneity) by using a 2-level model.

While the fact that people living in the Swiss German speaking part are better accessible is remarkable, it can be expected that households in the refusal conversion fieldwork phase are more difficult to be accessed. That larger households are much easier to be contacted (1.49 times per additional household member) as well as households with pensioners and also with children[4] is not surprising. First calling pensioner households on a weekday late afternoon lead to comparatively more contacts. Similar results hold for households with children when they are called after 5 pm. Generally the later the time on working days, the easier is it to obtain contact with households at the first call. Calling at a time when the household has first been accessed in the previous wave increases the likelihood of contact.

We check if calling at these favorable times may eventually backfire in that some of them may create annoyance among the households and lead to a decreased ultimate cooperation. Instead of calls until first contact, we use first contacts only, and analyze ultimate cooperation as a binary dependent variable, again using a 2-level model and including the same variables. Log odds are listed in the last column of *Table 1*. It turns out that obtaining contact at first successful call times from the previous wave actually lead to a higher ultimate cooperation rate. Specific daytimes are however not significant for ultimate cooperation.

3.1.1. Second and later Calls

In the next step, we analyze later calls in case the household could not be contacted at the first call. Similar to work from others, we decided to limit the number of calls per household, to a maximum of 10 calls. We do not test interactions of the (socio-demography) X (time) type here, which is difficult to follow in real fieldwork anyway, from the second call on. Instead, we analyze if changing calling times5 over time is successful, and, if yes, how this develops over additional calls. Specifically, we include the main effects mentioned above (socio-demography, wave, original sample, refusal conversion phase, household size, "German speaking part of Switzerland", same time of day at which the household was first contacted in the previous wave, time of day, Saturday), plus the "time elapsed since previous call", and the following interactions in the backward regression:

- (Number of call: 2, 3 … 10) X (time elapsed since previous call)
- (Number of call: 2, 3 … 10) X (new time window in current wave)
- (Number of call: 2, 3 … 10) X (same time at which the household was first contacted in the previous wave)

Each call number is taken separately to detect nonlinearities when choosing the optimal time window and waiting-time specific strategy. The backward selection model (removal level: .01) removes *all* '(Number of call: 2, 3 … 10)' variables interacted with all three time window and waiting-time specifications such that only the respective main

[4] This holds also if the household size is controlled for.
[5] i.e, calling at a time (window) at which the household considered has never been called before during the current wave.

effects remain in the final model. Also the sample control and the time from 1 pm until 4.59 pm[6] are dropped. Interestingly the pseudo R^2 of the 'second through tenth call' logistic regression model amounts to .08 and doubles that of the 'first call' regression model. In addition to controlling for the clustering of waves in households, we control for the clustering of calls in waves in the final 'second through tenth call' hierarchical level-3 logistic regression.

As for the results, there are surprisingly high similarities to the coefficients of the 'first call' model. The within-household variance is slightly higher than that from the 2-level model for first calls. There are negative (linear) effects on accessibility with additional waves, and during the refusal conversion phase. Also for later calls, the chances to contact someone is higher in the Swiss-German speaking part. As for socio-demography, contactability is increasingly better with increasing household size, and in households with children and especially pensioners. Concerning the times of the day, again the later the more favorable are the calling times. Now Saturdays outperform the weekdays. As Figure 2 already suggests, the number of the call is negatively associated with the likelihood of obtaining contact. Also for later calls, choosing the same time window than was successful to obtaining contact in the previous wave increases the probability of contact. The same holds if a new time window *within the current wave* is chosen. Also, letting some time evolve since the previous (unsuccessful) call proves positive with respect to the chances to first contacting someone.

4. Conclusions

The strategy of the first days of fieldwork in a centralized household CATI survey is to obtain contact with as many households as possible. This saves time, and makes planning of the conduction of interviews easier. While finding favorable contact times for different household types have already been analyzed elsewhere, these studies suffer from three shortcomings:

- a nonrandomized assignment of interviewers to calls
- lacking possibilities to include unobserved household heterogeneity
- lacking possibilities to include call times already proven to be successful on the household level

The latter two issues can be investigated using panel data, the first when calls are assigned at random to interviewers. Both aspects are given in the Swiss Household Panel, a representative telephone survey in Switzerland.

Starting by using first calls on households across five panel waves, we show that the unobserved heterogeneity of contacting households at the first call is considerable and much higher than the explained variance portion by fieldwork controls, household type, and calling time and day. Such high values make the use of multilevel models

[6] This means that this time window is not significantly different from the reference category (weekday until 1 pm).

necessary. Using a 2-level random effects model, we confirm previous findings that large households, those with children and especially with a pensioner are easier to be reached, and that late afternoons and evenings are good times to reach someone on the phone. Using the time window at which the household was first contacted in the previous wave increases the contact probability also in the current wave. Importantly, using the first contact times from the previous wave also increase the chances to obtain ultimate cooperation, if contact can actually be established.

In a second step, we analyze *second and higher calls* in cases where previous calls did not lead to a contact. Also in the 3-level random effects model used, we find rather high within-household correlations, and also substantive within-household within-wave correlation. As for successful calling times to obtain contact, we find similar times than for first calls. Also the household socio-demographic types that are easier to be reached are the same than for first calls. While however the likelihood to reach someone over the phone generally decreases with the number of calls, Saturday mornings now becomes a preferable time window. Also letting elapse some time since the previous unsuccessful call increases the likelihood of obtaining contact.

Some recommendations concerning optimal calling times until contact is established are due: Generally, late afternoon (especially for pensioner households) and in particular evening shifts (especially for households with children), and Saturday mornings (for later calls) should be strengthened. If possible, the household should be called more often at the same time (window), at which it was first contacted in the previous wave. This is also correlated with higher ultimate household cooperation. Also alternating time windows in the current wave is a good strategy. Always alternating time windows is of course not possible and contradicts replicating the successful call time from the previous wave. Because of the higher chance to obtain ultimate cooperation we conclude that calling at the previous' wave successful call time is more important, especially during earlier calls. Finally, there should be enough time left between subsequent calls.

5. Literature

Brick, M., B. Allen, P. Cunningham and D. Maklan (1996) Outcomes of a calling protocol in a telephone survey. Proceedings of the Survey Research Methods Section. Alexandria, VA: American Statistical Association

D'Arrigo J., G. Durrant and F. Steele (2009) Using field process data to predict best times of contact conditioning on household and interviewer influences. University of Southampton/ University of Bristol

Dennis J., C. Saulsberry, M. Battaglia, A.-S. Rodén, D. Hoaglin and M. Frankel (1999) Analysis of Call Patterns in a Large Random-Digit-Dialing Survey: The National Immunization Survey. Philip J. Smith and Robert A. Wright, Centers for Disease Control, USA

Groves, R., F. Fowler, M. Couper, J. Lepkowski, E. Singer and R. Tourangeau (2004) *Survey Methodology*. New York: Wiley

Kulka, R.A. and M.F. Weeks (1988) *Toward the Development of Optimal Calling Protocols for Telephone Surveys: A Conditional Probabilities Approach.* Journal of Official Statistics **4**(4), 319-332

Lipps, O. and G. Benson (2005) Cross National Contact Strategies. *2005 Proceedings of the American Statistical Association, Section on Survey Research Methods.* Alexandria, VA: American Statistical Association: 3905 – 3914

Stoop, I. (2005) *The Hunt for the last Respondent: Nonresponse in Sample Surveys*. PhD Thesis, Utrecht University

Table 1: Log Odds of Household Grid Contact, by first and second or later (until 10th) call. z-values in Brackets. IA=Interaction Effect. Last Column: Effect on (ultimate) Cooperation at time of first contact. Data: SHP Call Data 2005-2009 until first contact with Household. -= removed in backward selection model.

Variable	**1st call N=28,060**	**2nd – 10th call N=57,070**	**Effect on cooperation N=11,841**
Control: Wave (1-5)	-	.95 (-5.4)	
Control: Original Sample (1999, vs. 2004)	-	-	
Control: Swiss German speaking Part (vs. F or I)	1.22 (6.0)	1.23 (6.2)	n.s.
Control: Refusal Conversion Phase	.91 (-2.3)	.80 (-5.0)	.24 (-13.6)
SocDemo: Nr. of People in Household (1,2,3+ Person HH)	1.49 (17.7)	1.47 (15.6)	.73 (-4.9)
SocDemo: Children under 16 in HH	1.14 (2.2)	1.46 (8.3)	52.8 (15.6)
SocDemo: Pensioner in HH	1.98 (15.2)	2.05 (15.9)	34.7 (15.7)
IA: (Pensioner in HH) X (Weekday 5 pm - 7 pm)	1.20 (2.4)		n.s.
IA: (Child in HH) X (Weekday 5 pm - 7 pm)	1.26 (2.9)		3.36 (2.8)
IA: (Child in HH) X (Weekday 7 pm - 10 pm)	1.29 (3.2)		n.s.
Time: Morning (until 1 pm is CONTROL)	ref.	ref.	ref.
Time: Early afternoon (1 pm – 5 pm)	-	-	n.s.
Time: Late afternoon (5 pm – 7 pm)	1.40 (7.1)	1.67 (17.0)	n.s.
Time: Evening (7 pm – 10 pm)	1.48 (8.9)	1.90 (20.4)	n.s.
Weekday: Saturday (until 1 pm)	n.s.	1.57 (8.8)	-
Nr. of calls within current wave	-	.91 (-6.8)	-
Same time (window) as first contact in previous wave	1.36 (8.7)	1.26 (7.4)	1.74 (5.4)
New time (window) within current wave	-	1.24 (8.6)	-
Time since previous call within current wave	-	1.03 (12.1)	-
Within-Household Standard Deviation (S.E.)	.60 (.03)	.71 (.03)	1.92 (.11)
Within-Household within-wave Standard Deviation (S.E.)	-	.32 (.12)	-