

# SKUTHI: Developing a tablet-based survey technology and its application in teaching research methods in social sciences

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Digital tablets and smartphones are increasingly becoming part of the daily life of people and a must in professional developments in so many disciplines. The dependence on internet availability of current tabled-based technologies prevents successful public polling in areas where there is no internet connection. In order to overcome those restrictions we have developed the Skuthi platform for android tablets and smartphones. Skuthi allows the selection of convenient samples on android tablets independent to internet connection. Moreover, Skuthi enables probability samples by polling the public viacellphones by using a random digit dealing (RDD) technique, and also filling the questionnaire on the same smartphone from where the interviewer is calling. The multifunctional potentials of Skuthi offer opportunities for its successful application in both developed and developing countries in a wide variety of survey setting. We are implementing Skuthi as a medium of public polling with students from our Research Methods courses as part of their fieldwork requirement for the course. The ability of today's students to navigate smartphones and digital tablets facilitates such an application and produces enjoyable and productive learning experiences.

**Keywords:** Tablet, smartphone, public opinion surveys, Skuthi

## Introduction

Digital tablets and smartphones are increasingly becoming part of people's the daily life around the world and a must in professional developments in so many sectors, including research (Mitchell, Rosenstiel, and Christian, 2012; Online Publishers Association, 2012a; 2012b). Public opinion surveys through internet-connected tablets have begun to be implemented widely during 2012, yet those techniques continue to be dependent on internet availability (Pew Research Center for the People and the Press, 2012) and 3G technology in cases when cell phones are used as a medium of survey. Therefore, such techniques prevent a successful conduction of public opinion surveys with tablets in areas where there is no internet connection and smartphones that do not have an internet plan with their service account.

Developing countries experience specific difficulties: First, the lack of widespread internet access narrows the sampling frame to unacceptable levels. Second, in cases when we need to stratify our sample, the lack of unreliable 3G technology makes impossible man-on-the-street and door-to-door surveys, while the paper-and-pencil survey costs much coding time and energy, and the entire coding process remains susceptible to coding errors. Third, some remote areas might lack cell phone connection while, in other areas, cell phone service is far from being reliable. By and large, while determinant in research success, the internet factor often remains outside of researcher's control. Under such

conditions, the quest for independence from uncontrollable factors remains a reasonable aspiration of field researchers.

Beside research, digital tablets can be a powerful tool for students to learn and appropriate survey techniques. We have observed that the very idea of using smartphones to study and participate in research projects have energized our students in the Research Methods in Social Sciences courses. Moreover, the course instructor can now rely more on data collected as part of students' practical work for the course since there is no longer any need for manual coding, indeed one of the most time consuming and erratic processes of the survey data administration.

During the software testing and survey implementation process we were able to notice software's limitations and imperfections. Some of the imperfections reflect the early stage of the software and its need for further updates in order to expand its applicability. However, at the early stage of its implementation, we were able to notice the limitations that specific socio-cultural environments represent to methods widely agreed as appropriate. Thus for instance, initially we thought that the relatively high number of elders and people from rural areas who decline to participate in one of our surveys that collects data on internet penetration in Kosovo might have to do with their difficulty to understand our consent message on the phone. While we hoped that man-on-the-street samples could produce better results, we realized that people's refusal to participate had more to do with their ignorance of internet than not understanding the informed consent paragraph.

This paper continues with an assessment of challenges to collect data in the Balkan through polling the public mainly by relying on our long experience in Balkan fieldwork. Then we outline Skuthi, a digital platform that we have designed to facilitate our data collection through public opinion surveys so we could overcome problems that have harmed our fieldwork for years. We continue with lessons learned from early implementations of Skuthi both in terms of its technological functioning and both its advantages and limitations in field research and teaching research methods. Finally, we draw some conclusions related to the need to further update Skuthi as well as improve its potentials in both data collection and as a teaching/learning technique in Research Methods in Social Sciences.

### **Polling the Balkans: Difficulties and opportunities**

While the Balkans represent a valuable opportunity for research in so many areas of social behavior, the underdeveloped state of social research in the region makes data gathering harder (Peshkopia, Voss and Bytyqi, 2011a; 2011b). Some countries do not contain established survey institutes and private polling organizations of the size and variety found in Western Europe and North America; nor do external organizations of that sort regularly employ people with the linguistic and cultural background to operate in many Balkan countries. External organizations such as Gallup do occasionally conduct surveys in the region by subcontracting to local groups such as NGOs or policy institutes, but social scientists generally find the associated costs to be prohibitive.

Door-to-door surveys are often inappropriate for many specific research questions. Door-to-door sampling methods are not feasible partly because informal buildings in some countries, notably Albania and Kosovo, have created an urban chaos that makes difficult and time consuming the random selection of dwellings. Moreover, residential patterns are complicated by the close proximity of single-family and multi-family dwellings. A door-to-door method would create strong and systematic biases in the sample by systematically leaving outside it either those who have just migrated to the city and reside in makeshift dwellings or newly created families who continue to live within the large house of the clan. Moreover, in some communities either the norms, the family structure, or suspicion of the state rule out approaching people in their homes. The combination of a political tradition of state's omnipresence in the entire life of the country with deep suspicion, and even

hostility, against it makes public polling in ethnic minority communities even more difficult.

From the 1980s, telephone surveys began to emerge as a superior sampling technique in the US (Dillman, 2002; Tucker and Lepkowski, 2008). However, landline telephone access and Internet usage are not systematically - and, until recently, in some countries, in a politically relevant way - distributed across the population, so landline RDD methods are not viable. In some countries, notably Albania, Kosovo and Macedonia, large sections of rural population lack landline telephony (for the effects on sampling of socioeconomic differences between those who do have household phone and those who do not - see Trewin and Lee (1988), Thornberry and Massey (1988)). Such absence that, indeed, represents the underdeveloped socio-economic conditions and often social status of that population excludes it from any sample, thus undermining chances to establish any probability sample.

However, cell phones are now widely used in the region and, too much of an extent, they compensate for the lack of landline telephony in the countryside, and that represents an opportunity to establish public polling probability samples within sampling frames that infinitely approximate their respective populations. Indeed, recently, the decrease of the household landline telephones in favor of cell phones characterizes many developed societies (Busse and Fuchs, 2009; Blyth, 2008; Link, Battaglia, Frankel, Osborn and Mokdad, 2007; Peytchev, Carley-Baxter, and Black, 2010; Vicente, Reis, and Santos, 2009), thus our efforts concern not only developing but also developed societies and our efforts to refine cell phone surveys techniques fit to a larger concern of the discipline. First, we face the insurmountable difficulty of finding subscriber lists; concerned of the privacy of their clients and fearing competition, private cell phone companies are not willing to disclose their currently operating cell phone numbers. Second, cell phone calls in the Balkans are relatively expensive outside the respective network. Third, telephone techniques need accurately trained people and people with the ability to properly communicate via the phone. Moreover, telephone/cell phone surveys require relatively expensive calling technologies and the related software.

The Balkans complicated ethnic and social structures add to the existing difficulties. Most often than not, ethnic minorities live adjacent of their brethren countries across the border in areas that are often covered by cell phone companies of the countries. Either because people from these areas have migrated across the border or because ethnic minorities in the Balkans have strong family and business connections with their brethren across the border, they often subscribe to cell phone companies from their “mother-states”—the state ruled by their ethnic brethren. Therefore, it would be impossible to reach those people by cell phone, thus creating a sample bias, or such efforts would bring into the sample only those who use cell phones of the country where they reside, thus sampling only those people who are more oriented to work with the country of their residence. True, minority people, like everyone in the Balkans, carry more than one cell phone, but difficulties such as the language of the interviewer might undermine from the start any effort to conduct public opinion surveys related to sensitive political issues, notably interethnic relations and regional foreign policies.

Therefore, we need to refine survey techniques that would help us to overcome these idiosyncratic situations. First, we need to be able to successfully apply cell phone RDD techniques. Second, we need to be able to reach those ethnic and social groups which we cannot reach through cell phone RDD. That would include sampling by combining cell phone RDD, landline telephone RDD and face-to-face interviews in ethnic minority areas. Third, in order to increase efficiency, we should aim at the same survey technology or, at least, a survey technology that responds to most of our needs.

## **SKUTHI: The promise of a survey digital platform**

In order to overcome some of these limitations and take advantage of the opportunities that polling the public via cell phones represents in the Balkans in terms of establishing probability samples we, an international team of social scientists and software programmers, have developed the Skuthi platform for android tablets and smartphones. Skuthi has been developed using Java programming language, and utilizes the standard android operating system and its software development kit (SDK) and application programming interface (API). Further, this version of Skuthi, has been designed to be compatible with older versions of the APIs to support lower-end devices and thus enable usage on a cost effective hardware - surely it is compatible with upward versions of android APIs and SDKs. It has been built to utilize a local relational database, using SQLite, a public domain license type database, for question and response management. In the current version of Skuthi, question import, loading questions into the Skuthi, and question export, collecting responses from the Skuthi, is done through a SQLite management software tool. This requires that the tablet or phone be connected to a personal computer (PC) or a laptop while the export/import is being processed. Alternatively, one can connect phone's or tablet's external memory (i.e., SD Card) to a PC or a laptop.

Skuthi's interface is user friendly and uses a simplistic design. For instance one may navigate through previous questions and make any necessary changes until the survey is complete, at which time no further changes are permitted. The application record date and time for each response, starting from the first question, and save responses on persistent storage every time the interviewer switches to the next question. This assures that the progress is saved in case of unexpected interruptions. Skuthi allows to establish man-on-the-street and door-to-door convenient samples on tablets and smartphones independent from internet connection. A smartphone that has a screen large enough can be used both for cell phone surveys and convenient samples. A trained user can navigate easily among questions, and a good device would help to swiftly receive the response and switch to the next question.

Moreover, applied on the right cell phone device, Skuthi enables cellphone public opinion surveys on the same smartphone from where the interviewer calls the respondent. In the conditions when the researcher cannot access the list of the assigned telephone/cellphone numbers (Fortora, Groves, and Peytcheva, 2008; Mohorko, de Leeuw, and Hox, 2013) Skuthi can implement a RDD sampling among potential cellphone numbers. Simple actions make possible the programming of the specific survey and the extract of the data in a MS Excel spreadsheet. We argue that the multifunctional potentials of Skuthi offer opportunities for its successful application in both developed and developing countries in a wide variety of survey setting.

By switching telephone survey from landline phones and desktop/laptop survey directed methods to cell phone, Skuthi allows an inexpensive transfer of the "survey booth" to practically everywhere. For instance, without even leaving Kosovo, but just approaching its borders, we can survey cell phone holders in Albania, Macedonia, Montenegro and Serbia. By the same token, we can survey cell phone holders in Greece and Italy without even leaving Albania. From this perspective, Skuthi will revolutionize our way of conducting research with a much smaller budget and human resources will increase the mobility of research teams and would be able to efficiently establish cross-countries longitudinal data with much smaller costs.

Skuthi carries the following key features:

- Allows for filling the questionnaire on the same smartphone from where the interviewer calls
- Randomly selects a telephone number from a previously entered range of possible numbers
- Allows for the implementation of open-ended (textbox) and close-ended (response options) questions

- Randomly rotates the response order from one respondent to the other
- Allows for the return to the previous answer and correct it
- Does not allow to move to the next question unless a response is given to one of the optional answers
- Stores data in a SD or mini SD card and the researcher can easily transfer them to a computer.

Let's analyze more in details these features. First, Skuthi is designed to take advantage of the European cell phone system. Different from the US, in many European countries cell phone companies have their own code. Therefore, the pollsters can only put a range of possible numbers to receive a random number which they can call. It might be possible that the number has not been assigned but, after a number of failed attempts, the researchers will probably reach an assigned number. Obviously, this technique suggests calls within a single network, but this would be necessary also for another reason: often, companies offer discount prices or free call time for calls within the network. Thus, the total sample would be created by separately finishing with one network and switching to the SIM card of another network and randomizing numbers within its range.

In order to use the smartphone from where the interviewer calls also as a digital tablet where the interviewer fills the questionnaire, he/she should use headsets that allow hands-free operation. All the current smartphones carry Bluetooth technology, but we are reluctant to recommend Bluetooth headsets since they would represent an additional power-dependent device which could run low on battery right in the midst of a survey interview. Instead, we recommend headsets connected with the smartphone and dependent on its power, while the smartphone itself remains plugged in a power outlet during the entire time of survey interviews.

Upon hitting the Skuthi app installed in a cell phone or digital tablet, the user will see two horizontal bars. The upper bar is divided in two boxes (Previous and Next) with only Next operating in the first page. This bar serves only to those who want to use the smartphone as a digital tablet or are using a digital tablet to conduct public polls, and they should ignore the lower bar. The lower bar writes "Display Random Number Generator" and serves only for telephone surveys. Upon hitting the lower bar, it transforms to three bars, the upper one asking "From Number?" the next one asking "To Number?" and the lowest one suggesting "Generate." The "From Number?" bar serves to enter the minimum number of the number range, and the "To Number?" serves to enter the maximum number of the number range. After entering the minimum number, the keyboard offers the "Next" command on the lower right corner of the screen, which opens the view of the lower bar where the interviewer puts the maximum number and then press the command "Done: on the lower right corner of the screen. Upon hitting the "Generate" command, the program leads to a window with a randomly generated number, the question "Call this number?" and two boxes, "Call" and "Cancel." The latter sends back to the already entered minimum and maximum numbers, while "Call" sends to the calling functions of the smartphone and the interviewer should hit the call button of the smartphone.

It is likely that, upon performing the call, the interviewer will hear this-number-does-not-exist or this-number-has-no-access-to-the-network messages from the network's automatic response service. In those cases, the interviewer can use the touch screen go-back option to go back to the already entered minimum and maximum numbers and hit the "Generate" bar again to randomly extract a new number. The same is the case when the call goes through but no one picks the call. Yet, after each successful call, the interviewer should start the process from the beginning and insert the minimum and maximum numbers all over again. Once a respondent picks the call, the interviewer opens the questionnaire smartphone from the touch screen go-back option. From this point, the smartphone operates also as a digital tablet and the interviewer can fill the questionnaire on the same smartphone from where he/she is calling.

Skuthi allows the implementation of both open-ended and close-ended questions. An open-ended question is associated with a textbox and hitting it opens a keyboard with both numbers and letters. After filling the response, the interviewer can remove the keyboard by hitting the touch screen go-back option. Since the program does not allow to switch to the next question unless the interviewer enters a response, in the case of a conditional open-ended question, the interviewer can simply enter a “.” and then click the “Next & Save” button. In the case of a conditional close-ended question, the survey programmer can add the option “Pass” to move to the next question in the case the conditional question does not apply to the current respondent.

In order to avoid moot responses from people with attention disorders who tend to focus on the first or last question, Skuthi randomly rotates the ordering of all optional responses from one questionnaire to the other. The moving from one question to the next one happens through the “Next & Save” button, yet that cannot happen unless the interviewer has clicked one of the offered response options. However, the user can free use the “Previous” button to go back to already answered questions and change them. At the end of each questionnaire, the program offers a button that moves the interviewer to the next questionnaire.

### **Learning polling methodology hands-on: The class and field experience**

Besides its research benefits, Skuthi carries immense didactic potentials as it can easily help students to embark on data collection as practical work for their Research Methods in Social Sciences course. Students are active users of smartphones and digital tablets and their training in collecting data through Skuthi should be easy. Moreover, we expect that using smartphone and digital tablet technology to conduct public opinion surveys and other data collection activities can be more enjoyable than the cumbersome paper-and-pencil method. Therefore, students will have an opportunity to learn about such a methodological and technological innovation while collecting valuable data for our various ongoing research projects.

We began testing Skuthi 1.0 version with a mock survey on internet penetration in Kosovo. We wanted to test several features of the software, but also “test waters” for a real survey on that topic that has been commissioned to the Universum College by Shoqata për Teknologji të Informacionit dhe Komunikimit të Kosovës (STIKK) [Kosovo Association of Information and Communication Technology]. We purchased a €3.00 prepaid SIM card from the IPKO company with a total of 1,000 free minutes within the network (200 minutes each month with a €1.00 renovation per each month for a period of five months). We began testing the software in an office setting in the presence of its authors and via cell phone surveys using the RDD technique; then we moved the RDD surveys in the classroom; we continued testing in a fair in Prishtina, Kosovo, while we were presenting the software; and finally we applied some man-on-the-street surveys. The short time that we have to test the program was enough for us to assess its advantages and limitations, and also draw tasks for further improvement with the 2.0 version, which would also be the commercial version, scheduled to be released on September 1, 2013.

Combined in the office setting and classroom, we performed 41 cellphone calls and in 25 cases, the call went through while in the other cases the machine operator responded either “this number does not exist” or “this number has no access to the network.” 20 people picked the phone. From those, 8 people agreed to respond to the questionnaire while 12 people declined. However, a trend emerged: students noticed that most of the people who refused to respond were aged males, probably from the rural areas who, as student interviewers witnessed, seemed confused. In another case that we recorded as a responded questionnaire, one apparently older person passed the cell phone to a young lady, apparently his family member. In one case, the instructor of the Research Methods class and co-author in this paper, Ridvan Peshkopia, performed himself cell phone calls, reached a person, apparently an elder lady, who declined to respond. In the end, everyone who we were able to interview was an internet user, something that showed a tendency of

our RRD method to produce a biased sample. Thus, while at the 40 per cent, we can claim to have reached a workable response rate, the sample bias emerged as a problem.

*Students of the Research Methods in Political Science with the Universum College Kosovo watch over as student Valbona Gashi conducts a Skuthi-led cellphone survey*



*Students of the Research Methods in Political Science with the Universum College Kosovo watch over as student Mimoza Mena conducts a Skuthi-led cell phone survey*



Skuthi was also tested in the field. During a trade fair where Skuthi was showcased, a series of surveys were conducted. Skuthi app was installed on an Acer Iconia A500 tablet running Android version 3.2. The application functioned as expected. The interviewer

would read questions to an interviewee and would share the tablet screen at the same time. Because tablets provide the advantage of mobility, interviewees were also able to read the questions, and at times complete the whole survey on their own. In total there were 35 responses, out of which 6 did not want to participate. This survey consisted of 12 questions, with a mixture of open ended questions and a set of preset answers. Response rate was around 83%, and on average it took under 5 minutes to complete the survey. The minimum time to conduct a survey was slightly above 2 minutes and the maximum time was around 11 minutes. We found that the discrepancy was primarily contributed to interviewees' proactive behavior; those who would read questions and answers, in addition to listening it from the interviewer, were answering faster. Further, a noteworthy observation had to do with certain questions and the comfort level for an interviewee to answer them honestly. For instance, a question from this survey asked for interviewee's age group. A considerable number of interviewees preferred to answer the question themselves and click on the next button; they did not want to explicitly make this information available to the interviewer.

In an earlier paragraph, we describe the tendency of our RDD to produce a biased sample that included only internet users. Now the question was: Does RDD have an inclination to produce a biased sample in Kosovo because of some socioeconomic and cultural idiosyncrasies of the country, or that tendency toward the bias has anything to do with that particular survey? In order to response that question with accuracy, we need to apply our RDD method with different surveys and compare response rates. However, with the limited time until the submission of this paper, the only thing we could do was to understand somehow the reasons why no one without internet access or who does not use internet appears in our very small sample. In order to understand better the reasons for elder people's decline to participate in our survey, we decided to conduct some man-on-the-street surveys in the Kosovo capital city, Prishtina. Prishtina is a growing city mainly through waves of migration from the countryside. Moreover, Kosovo is a small country and it takes no more than 90 minutes from its most distant sites to reach Prishtina. For that reason, it is easy to find on the streets of Kosovo many people from all across the country. Our two students went in the field by using as tablets the same smartphones that they previously used to conduct cell phone surveys. Each of the conducted six surveys for less than two hours and, again, all of them were internet users. We realized that the response rate remained the same and so did the demography of the responders. However, this time students were able to confirm that elders, especially those whose dialect told they were from the countryside declined to respond, saying that they knew nothing about internet. Those responses confirmed our previous fears that not the RDD but the survey design might have been the cause of such a bias tendency.

## Conclusions

Of course, our very limited sampling activities cannot allow for accurate inferences. However, during our simultaneous efforts to test the Skuthi software and train students in data collection through public opinion surveys, we were able to both assess Skuthi's advantages and disadvantages, and draw some rough conclusions about the applicability of the survey on internet penetration in Kosovo. Certainly, those are not separate issues; technology creates opportunities for survey techniques and the latter affect response rates and sample distribution. Therefore, a simultaneous testing of both the software and a new questionnaire on a topic that has been surveyed before would offer opportunities to test the effect of both the software and the survey on each other. We were able to assess the huge advantages of Skuthi in performing RDD sampling, but also noticed some limitations that can be easily overcome with some updates and/or with a new version of Skuthi that is scheduled to be released on 1 September 2013.

During the testing, we noticed the value of testing the software with a new version of a previous questionnaire. First, we realized that the current limitations of Skuthi do prevent for its wider application more than we previously thought. However, knowing that the

overcoming of such problems does not represent any technical challenge, we are optimistic that soon we will have an updated version of the software. Second, during the testing of the software with a mock questionnaire related to internet penetration in Kosovo, we noticed low response rates of elder people, especially those who seemed from rural areas. Therefore, we were not able to dissect how much of the 60 per cent decline rate represent people's non-participation because they know nothing about internet and how much of that response decline represent other reasons for non-participating.

We learned from a consultation with experts from STIKK that last year, implementing a similar questionnaire, they noticed a high decline rate among young people while the elder were more patient to fill the questionnaire. Such conclusions so opposite from ours bring about questions related to the difference between the informed consent paragraph implemented last year and the our mock survey as well as questions about the training of the interviewer last year and this year. However, we were able to learn that RDD cell phone surveys do not bring any significantly different response rate from face-to-face survey, at least not in this case. Whether response rates in cell phone RDD and face-to-face interviews would change for surveys in other topics, this is something that we and our students will learn during the summer.

Finally, we have happily witnessed high energy and enthusiasm of students when practically applying their course-long theoretical knowledge. Having taught this course for many years and in different universities across the Balkans, we realize that the very innovative way of cell phone and digital tablet surveys offered by Skuthi created among students an environment of intellectual curiosity and challenge, and a sense that what they were doing was something important not only locally but also internationally. Coupled with the technological innovation offered by Skuthi, the very process of data gathering has received now a new meaning among the students. Therefore, we are currently entering what seems to become one of the most productive data gathering seasons of our academic careers, and we hope that soon we will be able to report new findings.

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