Edinburgh, Scotland
EURONOISE 2009
October 26-28

Subjective Noise Web-Based Surveys

Miguel Ausejo [a], Manuel Recuero [b]
Instrumentation and Applied Acoustic Research Group (I2A2). Technical University of Madrid (UPM).
INSIA-I2A2. Campus Sur UPM. Ctra. de Valencia, km7. 28031. Madrid. Spain.

María del Carmen Morillo [c]
ETSI Topografía, Geodesia y Cartografía. Technical University of Madrid (UPM).
ETSI Topografía. Campus Sur UPM. Ctra. de Valencia, km7. 28031. Madrid. Spain.

ABSTRACT

As a partial result of a research project, this paper analyzes the answers obtained from the noise surveys carried out by Internet to the neighbourhood in a small city in Spain. Specific surveys were designed following the International Standard IS0-15666.

A total of 134 valid surveys had been obtained, taking out social conclusions to reduce the noise and improve the life quality of neighbours in the studied area. Several conclusions are extracted from the study, as social conscience, noise subjective evaluation, noise effects on people and proposals to reduce noise in the area. Also a brief comparison between traditional distribution with Internet distribution results has been made.

1. INTRODUCTION

As a complement of noise mapping, subjective noise survey is a very useful tool to achieve population opinion and their responses to noise. It is completely necessary to know population opinion to carry out local and specific noise action plans, as defined by European Directive 2002/49/EC ***[1]***: "*…should be drawn up by the competent Authorities in consultation with the public".* Therefore we try to evaluate the studied zone in a subjective way to complement the objective results achieved by measurements and simulation techniques.

[a] Email address. mausejo@i2a2.upm.es
[b] Email address. manuel.recuero@upm.es
[c] Email address. cmorillo@topografia.upm.es

2. WHY WEB-BASED SURVEYS?

Internet allows access to a larger number of samples of individuals than traditional methods. Due to anonymity that Internet offers, the questions can be answered in a more comfortable way than traditional surveys. Many samples can be carried out in a very brief period of time. Answers can be validated in real time when typing in adding warning filters when an erroneous data has been entered ***[2]***.

Nevertheless, the Internet surveys usually have an implicit bias, such: having access to computers networks, having skills to fill up Internet surveys, and feeling comfortable with the accomplishment of Internet surveys. Due to these and other reasons, there are certain under-represented groups, like: *"women, people of limited financial resources, members of some racial and ethnic minorities, people at low education levels and older age groups"* ***[3]***.

In addition, there are other reasons for which an Internet survey can throw little trustworthy results, like multiple responses from the same respondent; nevertheless this problem has been solved limiting to one IP address by survey. Thus different users could not fill in a survey with the same computer.

3. DESIGN OF THE SPECIFIC NOISE QUESTIONNAIRE

The design of the noise surveys used in this study has been improved since 90`s by several members of I2A2 (Instrumentation and Applied Research Group) including sociologists, statisticians and acousticians. This questionnaire has been modified according to international recommendations ***[4]*** and benefited from the feedback of other studies ***[5, 6]***.

Currently this questionnaire is formed by 40 questions, including closed-questions, opened-questions and multi-answer questions. In order to compare the results obtained via paper and pencil administration (PNP) with those obtained via the Internet (IA) ***[7]***, we maintained the questionnaire used via PNP ***[8]***, and we followed several recommendations on web-based surveys design ***[9, 10]***.

4. SURVEY EXECUTION

This study was carried out in Pozuelo de Alarcón, a small city of 80,000 inhabitants in Spain. The Internet survey was advertised on the official website of Pozuelo de Alarcón city Council (Fig.1). Apart from the website, it was also advertised in the monthly local magazine in order to encourage population to fill it.

More than 350 people accessed to the Internet questionnaire but only 134 of them filled it in correctly. To study the rejection percentage, several considerations should be taken into account ***[11]***:

- Access or use of the Internet.
- Willingness to participate in Internet surveys.
- Response to the Internet survey.

Although it was a pilot experiment on a small city, the results obtained can be considered as a valid first approach for further studies.

Figure 1: Official website advertising the noise survey.

A. Validation

In order to check the validity of the survey carried out, we compared the population pyramid obtained with that gathered by the National Statistics Institute (*INE*) (Fig.2). It is observed that the group between 35 and 39 years remarkably defers from the data provided by the *INE*, as shown in other studies ***[3]***.

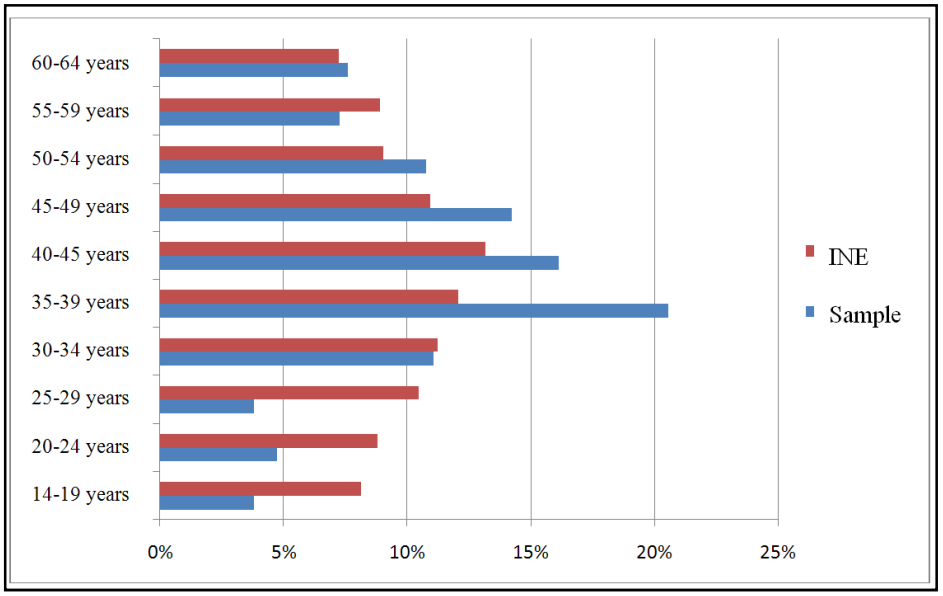


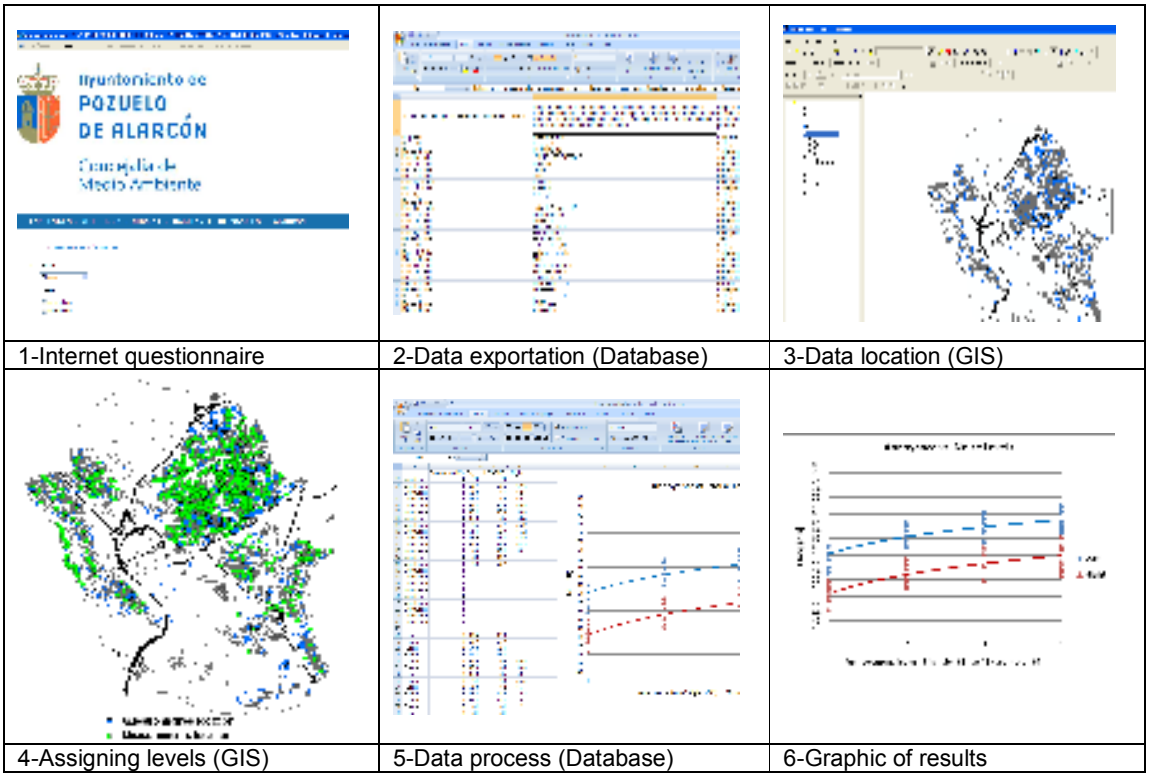
Figure 2: The population pyramid obtained compared to INE pyramid.

B. Methodology

The present study consists in comparing questionnaires results with noise measurements made in more than 200 locations.

The whole process to carry out this comparison is described below and summarized on Fig.3:

- Designing Web-based questionnaire.
- Testing the access to the questionnaire and data recording.
- Publishing the questionnaires on the City Council Website.
- Collecting respondents' data.
- Creating a database.
- Exporting respondents' data to database.
- Locating respondents on a GIS system.
- Locating noise measurements on a GIS system.
- Assigning noise levels to questionnaires data.
- Exporting all data from GIS system to database.
- Process data.
- Obtaining graphics and conclusions.



1-Internet questionnaire	2-Data exportation (Database)	3-Data location (GIS)
4-Assigning levels (GIS)	5-Data process (Database)	6-Graphic of results

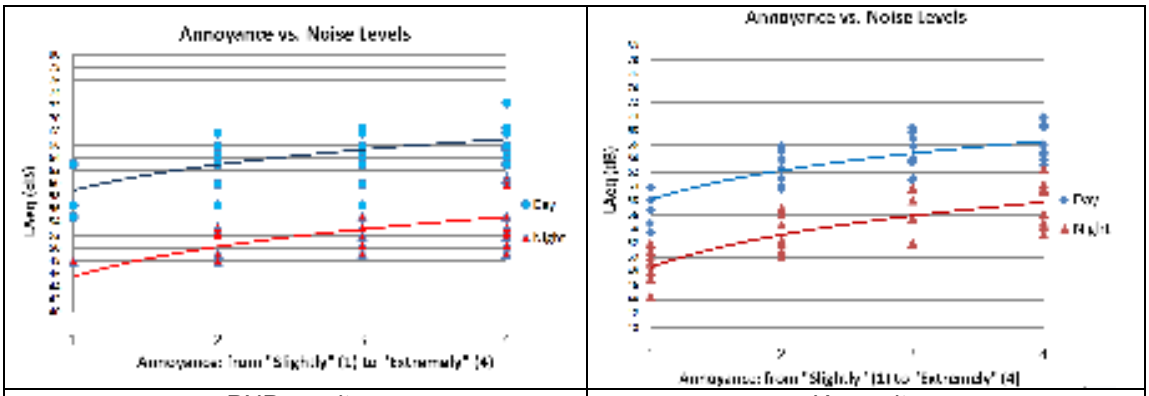
Figure 3: Research outline.

5. INTERNET (IA) AND PENCIL-AND-PAPER (PNP) COMPARISON

Although there are several methodological limitations to make equivalent comparisons between IA and PNP methods, several studies demonstrated a good agreement between both methods ***[7]***.

A. Noise annoyance

Therefore we compared noise annoyance results achieved by 228 questionnaires via PNP with 134 questionnaires via IA (Fig.4).



PNP results	IA results

Figure 4: PNP vs. IA noise annoyance results.

Results are very similar, showing small differences caused by IA biasing.

B. Economical valuation of noise

Answering the question via IA: “If you had a house freely offered for living…” the most chosen answer was: “125000€ house, very silent (40 dB by day and night)” with 54% of answers; compared to the result via PNP: “250000€ house, moderately noisy (60 dB by day and night)” with 42% of answers.

Most of the population (74%) surveyed via IA would pay an extra amount of the total price of a house placed in a very quiet zone. The average amount is 12.5% of the house price. These data are higher than those from other Spanish studies ***[12]*** but very similar to those achieved via PNP (69% of population and 11% of the house price).

Most of the surveyed inhabitants via IA (90%) think that the City Council must use city budget to decrease noise and the option most frequently chosen was 5€ per citizen per year. Results achieved via PNP are practically identical (89%).

Concerning the question “Are you willing to pay to decrease noise levels in your living area?” 70% of the respondents via IA are determined to pay for it and 66% of the respondents via PNP. The mean value to decrease noise levels willing to pay per dwelling and per year is approximately 17.0€ via IA and 17.6€ via PNP, which is a different amount than that of other Spanish localities ***[12, 13]*** and international studies ***[14]***.

Average L_{DEN} suffered by population willing to pay an amount of money (closed-option in the questionnaire) in order to reduce high noise levels is shown on the figure below (Fig. 5).

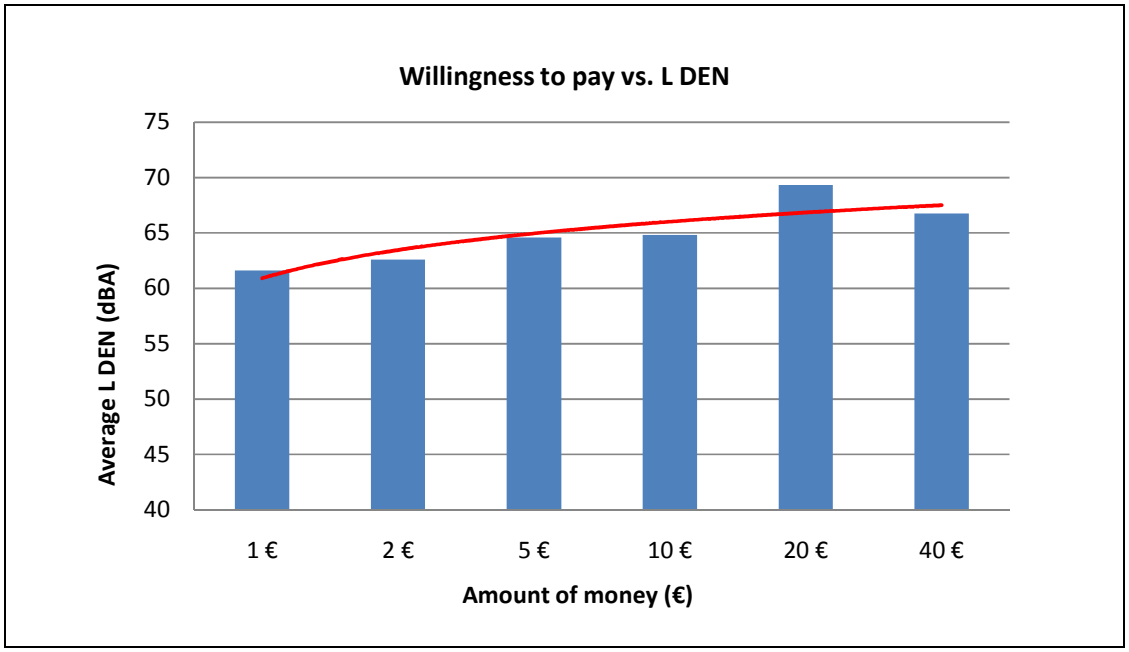


Figure 5: Average L_{DEN} vs. amount of money to decrease noise levels.

6. CONCLUSIONS

The main conclusions of this paper can be abstracted as follows:

- Main subjective annoyance perceived matches up with highest noise levels measured.
- This Internet diffusion technique speed up data processing, handing over and collection of the questionnaires compared to traditional techniques.
- This Internet diffusion technique needs a great advertisement campaign in order to obtain the necessary number of questionnaires to be statistically representative.
- It can be observed a Systematic Bias on population pyramid, due to the few use of new technologies by some population groups.
- Although the number of questionnaires received correctly is lower than those received by traditional methods, noise annoyance and economical results match up statistically, even without considering the systematic bias on population pyramid.
- This kind of surveys provides very useful data to develop noise management actions and local action plans ***[15].***
- If a noise survey were made in any noise mapped location, a willingness to pay to reduce high noise levels could be used to establish the external costs of noise and costs of noise reduction ***[14]*** more accurately.

In conclusion, we consider that the Internet is a perfectly valid tool to gather opinions and valuations of noise, its effects, and costs. Nevertheless, it is necessary to complement Internet surveys with PNP methods to obtain representative samples of the distinct groups of population in big agglomerations ***[3]***. The most effective technique, combining the advantages of the traditional methods with Internet surveys, consists in selecting a well representative previous sample and carrying the Internet survey out with the sample previously selected ***[16]***.

ACKNOWLEDGMENTS

The authors are very grateful to Environmental Department of Pozuelo de Alarcón City Council for hosting and advertising the link questionnaire and *Encuestafácil* for hosting the Internet survey web page.

REFERENCES

1. DIRECTIVE 2002/49/EC of the European Parliament and of the Council of 25 June 2002 relating to the assessment and management of environmental noise.

2. SMITH, M.; LEIGH, B. Virtual subjects: using the Internet as an alternative source of subjects and research environment. Behavior Research methods, Instruments and Computer, 29 (4), 496-505, 1997.

3. ZHANG, Y. Using the Internet for Survey Research: A Case Study. Journal of the American Society for Information Science, 51 81), 57-68, 1999.

4. ISO/TS 15666:2003 Acoustics – Assessment of noise annoyance by means of social and socio-acoustic surveys. Group Assessment of Exposure to Noise (WG-AEN), 2003.

5. AUSEJO, M.; RECUERO, M. Subjective study of the noise in several hospitals in the Autonomous City of Buenos Aires. The 13th International Congress on Sound and Vibration (13ICSV). Viena, Austria. 2006.

6. AUSEJO, M.; RECUERO, M. Subjective study of the noise in several schools in the Autonomous City of Buenos Aires. 33rd International Acoustic Conference. EAA Symposium. Strbske Pleso, Eslovaquia. 2006.

7. EPSTEIN, J.; KLINKENBERG, D.; WILEY, D.; MCKINLEY, L. Insuring sample equivalence across internet and paper-and-pencil assessments. Computers in Human Behavior 17 (2001) 339-346.

8. AUSEJO, M.; RECUERO, M.; MORILLO, M. C. Research on subjective noise in Pozuelo de Alarcón. The 16th International Congress on Sound and Vibration (16ICSV). Krakow, Poland. 2009.

9. DALEY, E. M. ET AL. Conducting Web-based Survey Research: A Lesson in Internet Designs. American Journal of Health Behaviour 2003; 27 (2):116-124.

10. DILLMAN, D. A. Mail and Internet Surveys: The Tailored Design Method 2007 Update with New Internet, Visual, and Mixed-Mode Guide. JohnWiley & Sons Inc., USA, 2007.

11. COUPER, M.; KAPTEYN, A.; SCHONLAU, M.; WINTER, J. Noncoverage and nonresponse in an Internet survey. Social Science Research 36, 131-148, 2007.

12. MARTÍN, M. A.; TARRERO, A.; GONZÁLEZ, J.; MACHIMBARRENA, M. Exposure-effect relationships between road traffic noise annoyance and noise cost valuations in Valladolid, Spain. Applied Acoustics 67 (2006) 945–958.2006.

13. MARTIMPORTUGUÉS, C.; CANTO, J. M. Creencias ambientales y coste social del ruido de ocio. Revista de Acústica. Vol. 36 Nos 3 y 4.

14. INFRAS/IWW, 2004. External costs of Transport. Update study. Zürich, Karlsruhe.

15. HEPWORTH, P.; PAGE, J. A comparison of the results of a regional survey of attitudes to ambient noise with those of a national survey in the United Kingdom. Inter Noise. Prague, Czech Republic. 2004

16. SCHONLAU, M.; ASCH, B.; DU, C. Web surveys as part of a mixed-mode strategy for population that cannot be contacted by e-mail. Social Science Computer Review 21 (2), 218-222, 2003.