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EXPERIENCES WITH END ACTION PLANS AND ENVIRONMENTAL POLICY PLANS

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Abstract
After calculating and drawing lots of noise maps the real work did start: the discussions on how to reduce noise levels and how to improve the environment effected by traffic or industry. The noise maps were the starting point and had to trigger politicians and citizens. Is annoyance due to environmental noise more important than air pollution and do we have financial funding for actions and measures? This paper gives some experiences on these discussions and some pessimistic but also very optimistic and promising results. Not only on action plans but also on environmental policy plans. Some recommendations for the second round of the European Noise Directive will be given.

Keywords: action, plans, policy, funding

1 Introduction

In 1993 the European Commission ordered an investigation on the burden of exposure to environmental noise. This study concluded that more than 45 million of Europeans were exposed to high levels of noise. At certain spots the high noise levels resulted in poor living quality. Nearly 10 million of Europeans are exposed to levels that are a direct threat to their health. The outcome of the aforementioned study gave way to the directive on the assessment and management of environmental noise in 2002.

The main aim of the Environmental Noise Directive (END) [1] is to raise awareness and to come to local noise policy to avoid, prevent and reduce harmful effects on human health. Noise-annoyance and specially harmful effects on human health are very serious. Stress increases the risk of hypertension (high blood pressure) and cardiovascular diseases are the result.

De Kluizenaar found a correlation between Long-term road traffic noise exposure and an increase in morning tiredness[2]. In the period between 2001 and 2004 the RANCH Project investigated the influential effects of road traffic and aircraft noise exposure on children's cognition and health. The study concluded on the significant negative effects of high noise levels on children's cognition and health.
The World Health Organization (WHO) [3] investigated that thousands and more people around the world may be dying prematurely or succumbing of diseases caused by the more insidious effects of chronic noise exposure. The WHO's findings conclude that traffic noise itself is harming the health of almost every one in three Europeans. One in five Europeans is at night regularly exposed to sound levels that could significantly damage their health.

Therefore the main aim of the END is to make noise maps, to communicate on these noise maps and to make action plans to avoid, prevent or reduce harmful effects on human health and to communicate on these action plans. It is described that noise maps must be set up by the assessment of environmental noise in Member States, based on common methods ensuring that information on environmental noise and its effects is made available to the public. Actions shall be taken to reduce noise where necessary and to maintain environmental noise quality where it is acceptable and good. Other elements of the END are the harmonization of the noise indicators and the assessment methods. It is also described that the Member States should agree on targets for the common noise indicators and should inform the public on noise exposure and action plans. Some goals must be set on the reduction of the number of EU-citizens annoyed by noise with a policy with strategies and measures to reach these goals. The main focus should be on noise reduction at the source and the development of a future strategy on the protection of quiet areas is important.

2 Need for accuracy

Drawing up nice-looking, colourful, and perhaps also accurate noise maps can be done, but we have to realise that the noise map is only a tool to come to an action plan and to noise policy. To start a policy on noise, the map is only one of the tools available. There are more tools to investigate the annoyance due to noise.

Really important is that the annoyance due to environmental noise is related progressively to the noise level. An example of a relation can be seen in the graph below (Position paper [4]). To determine the degree of annoyance, it is not necessary to calculate noise levels with an accuracy up to one decibel. Even an inaccuracy up to 5 decibel is not important. For a distinction between a poor quality of the noise environment and an acceptable noise environment it can be stated, that above noise levels of about 65 to 70 dB the situation is not acceptable.

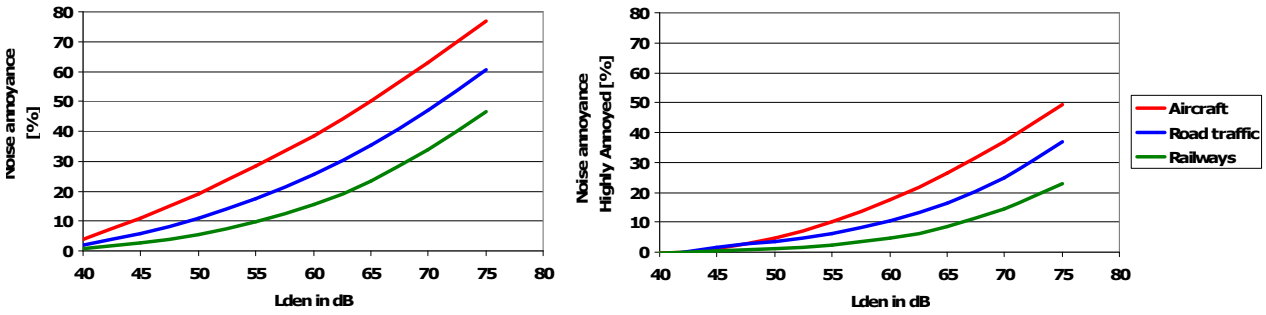

Figure 1 – The percentage of annoyed or highly annoyed people as a function of the noise level

The point is that some politicians, scientists and legal advisers need a 'hard' limit, such as: above 65 dB one is highly annoyed and below one is not. Sometimes it is for legal reasons necessary to calculate values within a tenth or even a hundredth of a decibel. All acousticians know this is unrealistic. For this reason a noise map drawn up by rapid prototyping tools as a 'bio-plotter' can do very well to determine the hot spots to take noise measures (figure 2). On the other hand it must be realized that calculations to determine the effect of low noise asphalt or noise barriers need to be more accurate because the effect of a measure can be in the order of magnitude of the inaccuracy.

Figure 2 – Example of a "Bio-plotter" noise map

The Environmental Noise Directive is not applicable to noise that is caused by the exposed person himself, noise from domestic activities and noise created by neighbours, In the main Dutch agglomerations (and especially the large cities of Amsterdam and Rotterdam) it is common knowledge that especially neighbours contribute significantly to noise annoyance. To improve the acoustical environment inside dwellings, it is also necessary to investigate the annoyance due to the noise caused by neighbours. Derived from data from investigations made all over Europe the graph shown in figure 3 can be compiled. The annoyance due to noise caused by neighbours is in the order of magnitude of the annoyance caused by road traffic noise. We also have to realise that this can even worsen when façade isolation has taken place in order to reduce the noise levels for road traffic noise; the neighbouring noise then becomes less masked.

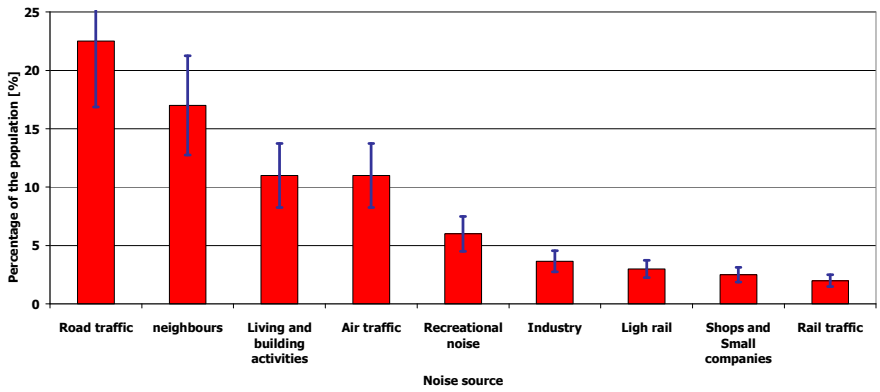

Figure 3 – The percentage of annoyed or highly annoyed people as a function of the noise level

There is an ongoing discussion on accuracy and uncertainty of noise calculations. For any mathematical engineering model of the actual real physical event, the result of a calculation may only be described as a best estimate of the actual situation. This is particularly true in the field of outdoor noise predictions based upon empirical models dating back several decades. It can be stated that 'a model is just a model' and 'predictions of noise levels can be as difficult as weather predictions'. More fundamental discussions on the uncertainty and un accuracy of a predicted noise level are in [6] and [7] .

Make validation measurements more statistically relevant by measuring the noise level for a longer period and with more microphones. An example is to measure with 5 microphones for 6 months (see reference [8]). Register the number of vehicles (or bogies) for every category and measure the average speed. Carry out these measurements at a distance between 25 en 50 meters from the road or the track.
For road traffic noise reduction of the uncertainty of the emissions effect of the road surface is possible by performing measurements with a microphone close to a tyre. In reference [9] it is described how to come to a much better result of a noise map.

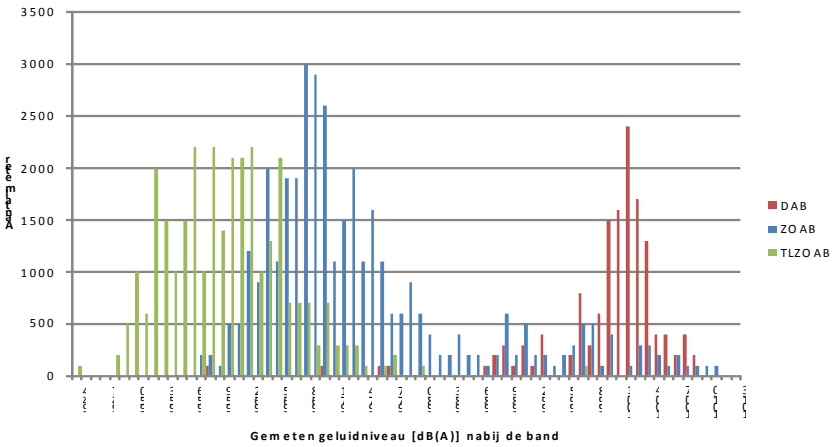

Figure 4 – The results of CPX-measurements on highway A50 and highway A59 close to the city of Oss in the Netherlands. The graph gives the results of three types of asphalt road pavement

Measurements with a microphone close to a tyre are the well known CPX-measurements according to ISO [10]. The principles of this method can also be used for railway noise by using a microphone underneath a train.

3 Calculation methods

All over Europe, there is a large variety of assessment or calculation methods. Beside these calculation methods, the need was concluded for a clear and more precise description of the input data and software calculation settings.
Different calculation methods [11] and [12] can give a large variation in results and values of 5 dB or more are not uncommon. So it was stated that there is a need for a common assessment method. Work for this is in progress see the CNOSSOS project [13].

A clear and more precise description of the input data and software calculation settings is one other issue. During the evaluations of different noise maps it became clear that several aspects result in very different noise maps. Two examples:

1. There is no description of the 'low flow roads'. This means that the roads with not so much traffic are incorporated in one noise map and they are not included in others. The criteria of L_{den} lower than 55 dB is not always included and the fact that two noise level contributions of 52 dB or three contributions of 50 dB is not considered. Even stronger in urban areas there might be a large number of roads which give a contribution of 45 dB. If we have a contribution of the noise level of more than 10 roads we have 55 dB or more.
2. In some software packages it is possible to adjust some parameters to speed up the calculations. For example the range for reflections, close to the receiver and range close to the source. (There are software packages which do not calculate the latter). One other parameter is the range in distance for a contribution of a source. Ignoring sources (or source segments of a road) will give a significant underestimation of the noise levels and, of course also the number of people in certain noise classes.

4 Presentation of noise maps

Noise maps are produced in various ways. And the colour setting is very dominant and predirective to the public. So more red colour is more dangerous than a map with more green colour.

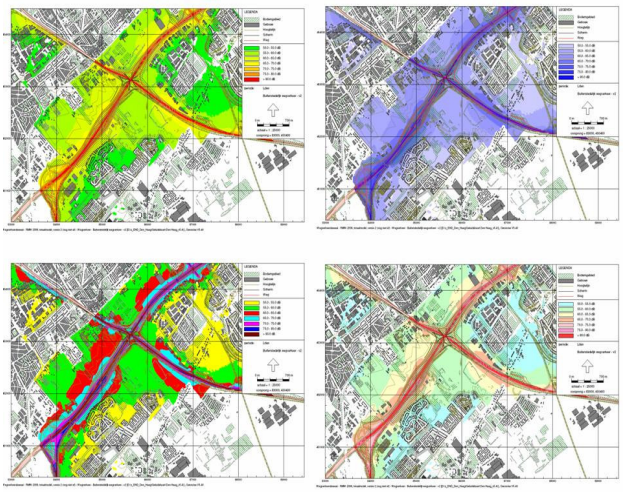

Figure 5 – Example of colours on a noise map

Figure 6 – Example of colours based on façade level

Beside the presentation of a noise map based on noise calculated on a large number of grid points in the street, we have to be aware that the level in the street is not the most relevant noise level, The façade level is more important, because this is directly related to the noise level inside the dwelling. For the public, and also for politicians, it gives more clearness to present a coloured mark to every separate building based on their façade level. Of course this method cannot be used for giving the results for (quiet) areas.

5 Information to the public

All over Europe most of the local authorities and even more the owners of the large noise sources (highway, railway and airport authorities) were relatively very reserved and reluctant in giving information to the broad public. There were some nice examples where authorities made some excellent brochures and leaflets with information and some noise maps. The city of The Hague made a clear information-booklet for its citizens, to clarify noise exposure in the different parts of the city. The city of Zaanstad (north of Amsterdam) made a web based application where its citizens could check noise exposure levels of individual dwellings. The city of Zoetermeer (in the proximity of The Hague) organised town hall meetings with a number of interested and worried citizens to communicate on the noise maps, combined with a common search for solutions for the noise-hot spots. We have to state that most of the authorities only put the data and some noise maps on their websites, whereas some noise maps were in a very low resolution, so you could hardly find your own house or your street close to your dwelling.

The main heard point is, that Europe or the National authorities did not supply the money to take any measures to reduce noise levels. This means that these local authorities had the idea, that their action plans were doomed to fail.
According to [14] the reason for this was, that there are no noise limit values defined in the Environmental Noise Directive. It was stated that this jeopardizes the main goal of the Directive. It was also stated that the implementation of the EU Directive on environmental noise is free of engagement. No harmonized system of legal protection or law enforcement is set up for noise control.

6 A result of a number of years noise policy

An interesting result is found in the city of The Hague. In this city the results of the noise maps were also presented in the percentage of the population annoyed by noise for the different districts of the city. The result is shown in figure 7.

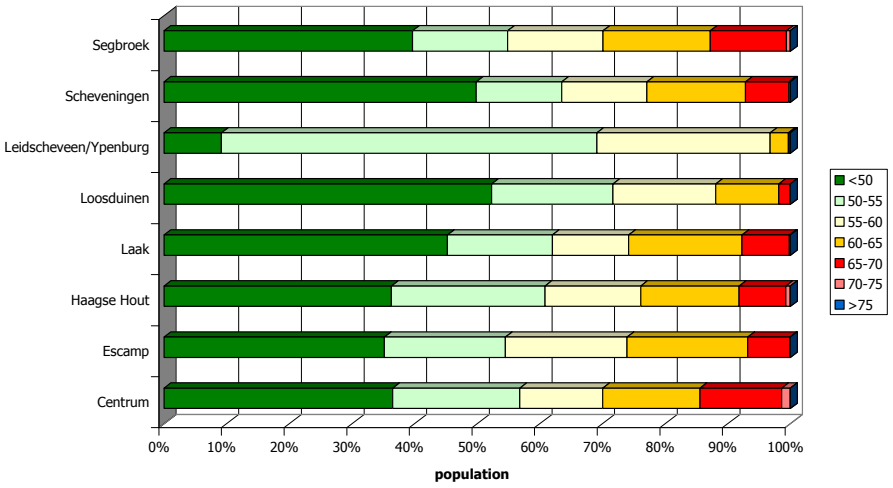

Figure 7 – The results of the noise maps presented in the percentage of the population annoyed by noise for the different districts of the city of The Hague.

The Leidschenveen/Ypenburg district of the Hague is a new developed area, located just between three highways (A4, A12 and A13). This district is in recent years planned and build under the Dutch noise act which allows to build dwellings below a certain noise level and with extra permission only a 5 decibels higher. Typical for this district is, that only 9% of the dwellings are exposed to noise levels below 50 dB and on the other hand only 3% of the population is exposed to noise levels of 60 dB and higher. There are no quiet areas and there are almost no distressing high noise levels. The majority of its inhabitants lives in noise levels between 50 and 60 dB. This is a glaring contrast to the population in other districts of The Hague. The Dutch noise act gives some hopeful results special for a district build close to three highways.

7 Action plans and noise policy

Setting up a noise action plan is a complex process to eventually come to a description of the policy to reduce the noise levels at dwellings. The final plan must provide in a list of specific noise reduction measures which the regarding authority wants to execute in the next five years, or even better for the long term.

Setting up a noise map takes some time but developing an action plan takes even more time. The forces involved for developing an action plan are much larger so more people and groups of people had to be consulted for this plan. In figure 8 a diagram is given for all the forces involved. What has to be realised is that some authorities are involved as the 'owner of the source'. Other authorities are involved as the 'protector of the inhabitants'. The protector of the inhabitant is also more a role with political forces. Does the city want to be a green city with high quality of living standard or does it want to be to more an economical or industrial centre where these activities are more important with the result that people had to live under higher noise levels.

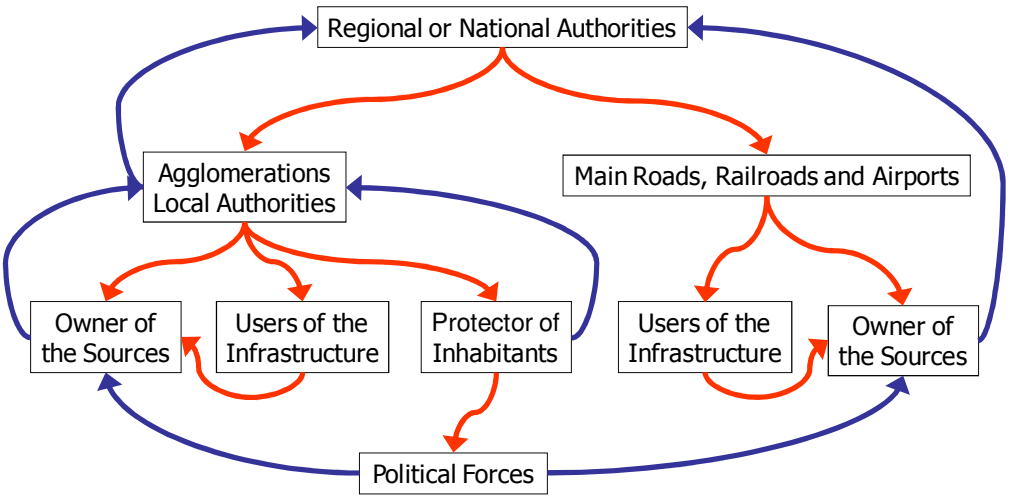

Figure 8 – The forces involved with action plans for road traffic noise

Evaluation of successful examples in the Netherlands shows the importance of combining the process of noise mapping directly to the process of action planning and communication to the public. Dutch authorities who have a long tradition of participating with the inhabitants in policy development, found it easy to come up with a sound approach. Those authorities are used to combine their perspectives with the perspectives of their inhabitants and were

relatively successful in thinking out the noise action plans. It is important that at the start up of the process a complete communication strategy is developed.

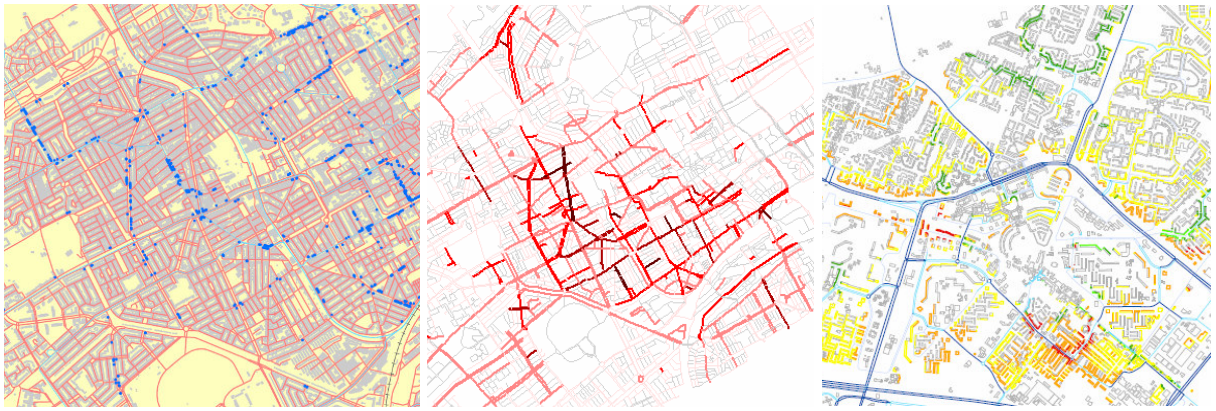

Figure 9 – examples of different calculation results of noise spots e.g. road of dwellings where action should be taken.

Inhabitants show a healthy distrust in calculated noise maps. Although acoustical experts can explain the validity of the used calculation methods, inhabitants do ask for a noise map which is funded by real time noise measurements. It seems that this is the main question for a broad acceptance of the noise maps.

8 Conclusions

The annoyance of noise is related progressively to the noise level on a noise map. Most noise maps only give information on specific sources. To improve the acoustical environment it may be necessary to investigate, for example, the annoyance of the noise from neighbours.

A noise prediction model is just a model. The absolute uncertainty of a predicted noise level is difficult to quantify, because there is also an uncertainty in the measured noise level. A measured value is only a random sample. We suggest making validation measurements more statistically relevant by long-term measuring the noise level for a complete day, evening and night (or, even better, a number of days, evenings and nights). A procedure with some well considered measurements can help to improve the accuracy of a noise map. Since a significant number of inhabitants distrust the validity of noise maps, will a well-defined monitoring measure strategy raise acceptance?

As stated before, lessons can be learned from successful examples. Evaluation of these examples shows the importance of combining the process of noise-mapping directly to the process of action planning and communication to the public. Dutch authorities who have a long tradition of participating with the inhabitants in policy development, found it easy to come up with a sound approach. Those authorities are used to combine their perspectives with the perspectives of their inhabitants and were relatively successful in the development of the noise action plans. It is thereby important that at the start up of the process a complete communication strategy is thought out and applied.

For the next round of noise mapping: transform the obligation into a chance to improve the quality for living, working and relaxing in our main cities. In our perspective we are able to address the issue by not only focusing on solving noise problems but by combining with the other topics and on sustainability. If we succeed in greening our mobility and ways and means of transport, we can successfully address the challenge of ensuring acoustic healthy living conditions.

References

[1] Directive 2002/49/EC of the European Parliament and of the Council, Official Journal of the European Communities, 2002

[2] Yvonne de Kluizenaar et al, Long-term road traffic noise exposure is associated with an increase in morning tiredness, Acoustical Society of America, 2009

[3] Dr Rokho Kim, Night noise guidelines for Europe, WHO Regional Office for Europe, Copenhagen, 2009

[4] Position paper on dose response relationships between transportation noise and annoyance, 20 February 2002

[5] European Working Group – Assessment of Exposure to Noise, Good Practice Guide for Strategic Noise Mapping and the Production of Associated Data on Noise Exposure, Version 1, 2003

[6] J.J.A. van Leeuwen, R. Nota, S.J. Shilton, J. Hinton, *Accuracy Implications of Using the WG-AEN Good Practice Guide Toolkits*, symposium on Managing Uncertainty in Noise Measurement and Prediction, Le Mans, 2005

[7] J.J.A. van Leeuwen, R. Nota, S.J. Shilton, *Error Propagation Analysis of XPS 31-133 and CRTN to Help Develop a Noise Mapping Data Standard*, symposium on Managing Uncertainty in Noise Measurement and Prediction, Le Mans, 2005

[8] J.J.A. van Leeuwen, P. Driessen, Measuring is knowing or is knowing also measuring? (Meten is weten of is weten ook meten?), Blad Geluid 4/2009 (in Dutch)

[9] A.Y. Kok, J.J.A. van Leeuwen, Exploring investigation on noise annoyance of highway A50 and highway A59 close to the city of Oss in The Netherlands (Verkennend onderzoek geluidhinder A50/A59 Bernheze, Landerd, Oss en Wijchen), DGMR Rapport V.2008.1650.02.R001, 2009 (in Dutch)

[10] Acoustics–Method for measuring the influence of road surfaces on traffic noise – Part 2: 'The close-proximity method', ISO/CD 11819-2.

[11] J.J.A. van Leeuwen, D. Manvell, R. Nota, Some prediction models for the calculation of traffic noise in the environment, InterNoise 1996

[12] J.J.A. van Leeuwen, Railway Noise Prediction Models: A Comparison, Journal of Sound and Vibration, 2000, 231(3).

[13] Stylianos Kephalopoulos, Marco Paviotti, Advancement in the development of European common noise assessment methods: where are we? (Cnossos)Euronoise Edinburgh,.2009

[14] M. Mannaart, E. Lemmers, The way to the sound of silence? Open University, 2007