Socio-organisational Interface Design

Between Airport Residents and Airport Management

D O C T O R A L   T H E S I S

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by

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Contents

Summary

The thesis at hand originates from German and Australian research projects supported by the German Academic Exchange Service (DAAD) and the Erich-Becker-Foundation. It deals with the design of the socio-organisational interface between airport residents and airport managements. The "point of contact" that defines this interface is the issue of noise. Noise and its abatement are assessed differently in the view of the residents and the airport management. The thesis points out why it is important and beneficial for both to improve the interface, especially the issue of noise by diminishing residents' noise annoyance. At the same time as annoyance is meant to be decreased, the residents' contentment with noise management is meant to be increased.

As noise annoyance is not only generated by acoustical factors such as noise level, an approach is chosen that also takes non-acoustic factors into account. Two of the most important non-acoustic factors are the accessibility and transparency of information and the possibility of participation. The intervention tool, the NoiseCall, facilitates and promotes these aspects.

In a quasi-experimental field study at the airports Augsburg and Kassel-Calden, the NoiseCall has been installed as a complaint and information service to facilitate a moderated information flow between airport management and residents. The perceived control and the coping strategies of residents were meant to be enhanced, and consequently, annoyance to be reduced and contentment with the management increased.

As a main result, the annoyance of Kassel residents, who used the NoiseCall, declined significantly. The contentment of this group increased, however below statistical significance. In Augsburg, no significant changes after the installation of the NoiseCall were detected. Annoyance correlated to a high degree with the fear of a loss in the value of the homes. Likewise, the contentment with the airport management is closely related to annoyance.

In a second step, data from Dortmund and Sydney Airport were analysed to investigate possible personality differences that might explain why some annoyed residents call a noise line, whereas others do not. However, the results on anger expression of users and non-users are not totally consistent. Still, German users can be characterised by less suppression of anger.

The NoiseCall as a tool to design the socio-organisational interface of residents and airport management is effective, if it is put into practice at an early point in time. According to the data at hand, it is effective at small-sized airports.

The described correlations of annoyance with the different non-acoustic aspects once again stress the importance of their consideration. The results of the regression analyis support their influence on annoyance as well.

Moreover, trust building measures to design and improve the interface of e.g. the system "airport" and "residents" have to match and meet the specific demands of the relationship between these.

Concluding from the study results the NoiseCall seems to be just one possibility (e.g. for small airports with a good relation to its residents) of a design measure. Apparently, partly due to the different personalities of residents, a manifold approach should be followed: an internet platform, for example, to lodge a complaint might be more attractive for residents who prefer more anonymity, while public meetings might attracts those who prefer face-to-face communication.

1 Introduction

1.1 Aviation and Environment

Against the background of the increasing need for mobility and the increasing air traffic on the one hand and the growing need for life quality in terms of a quiet living environment on the other hand, the interface between the system of air traffic and the noise affected people is a major concern.

Air traffic is steadily increasing. On the individual level the desire for mobility is one driver variable for aviation demand due to greater personal freedom, increased leisure time, greater tourism exposure, education etc. The main political and economic drivers are globalisation, air transport liberation, international trade, increasing regional economic activity, and airline alliances (Whitelegg & Cambridge, 2004). With increasing traffic, emissions are increasing as well with noise being one of them. Therefore, aviation is located in an area of conflict between the desire for mobility and the economic benefits and the desire and right for living in peace and quiet.

During the last decades the global demand for air travel has risen by 9 per cent per year and aviation growth is predicted at a slightly lower annual rate of 3-7% respectively for the foreseeable future (Airbus Industries, 1997; Boeing, 2003). At the moment airlines carry about 1.6 billion people and 30 million tons of freight each year. It is expected that the kilometres flown will increase by factor 3 and the number of aircraft will double within the next 20 years. Moreover, low cost carriers and the growth of short-haul flights and airfreight give modern aviation industry a different face (Whitelegg & Cambridge, 2004).

Air traffic has various environmental impacts: 205 million tons of aviation fuel are burned per year (OECD, 2002, in Whitelegg & Cambridge, 2004) producing over half a billion tons of greenhouse gases (IEA, 2002, in Whitelegg & Cambridge, 2004). The impacts are significant at the local level in terms of noise as well as on regional and global levels in terms of climate changes. Although noise is the emission focussed in the public and in this thesis, some other pollution caused by aircraft should be mentioned briefly (Vogt, 2003): During fuelling on the apron, the main pollutant is evaporating hydrocarbon (HC). The biggest problem on the apron, however, is caused by defrosting and fire fighting chemicals as well as tyre abrasion. The emissions from aircraft depict a critical aspect of global importance as they are brought out in sensible layers of the atmosphere. Most aircraft cruises take place in these sensible layers between flight levels 320 and 400 (10 and 12 km). The most relevant chemical pollutants of aircraft engines are nitrogen oxides. Nitrogen monoxides are oxidised by ozone to nitrogen dioxide. This chemical reaction produces not only nitrogen dioxide, but also adds to the ozone deficit. Apart from that, carbon dioxide and water vapour are produced, which contribute to the global warming. Humans might suffer from these emissions as they might come into contact via breathing, skin contact, food, or drinking water.

From the many emissions, aircraft noise still is a very prominent one, even though a lot has been done to abate noise and there are even greater goals ahead: e.g. the design of low-emission aircraft (Dobrzynski & Michel, 2002; Ising & Költzsch, 2004) and the development and implementation of low-emission approach and departure procedures (Isermann, 2000; Loose, Heimann, & Strauch, 2004). Noise emission of aircraft has been reduced during the last half century by around 25 dB mainly due to the improvement of the engines. It is discussed to reduce aircraft noise during the next 10 years by further 10 dB and 20 dB during the next 25 years considering not only engine noise, but also jet noise, fan noise, and airframe noise. Organisational and administrative changes to protect the environment against noise take a lot of preparation, testing and – in prospect of the “Single European Sky” – also international coordination. However, noise reduction at the aircraft themselves will affect noise levels only in the long run, as current aircraft will be in use for the next 10 to 15 years (Isermann, 2000). In the medium and short term there are political as well as operational ways of noise reduction: e.g. replacing old aircraft by modern low-emission carriers and thus compensating for the increase in movements (trading level to frequency of flights; Groll-Knapp, 2002; Vogt, 2002), financial incentives to use low-emission aircraft, noise limitation and standardisation, development of holistic traffic concepts (air-rail-bus public transport) and an improved air traffic organisation, such as controllers’ instructions for low-emission or relocation of flight paths.

In spite of the variety of ways for noise abatement, the growth of aviation has ensured that noise levels above WHO recommended values still affect millions of people (Whitelegg & Cambridge, 2004). 20% of the people in the European Union are permanently exposed to noise levels above 65 dB(A) during the day (Sachverständigenrat für Umweltfragen, 1999).

Statistics of the German Federal Department of Environment (Umweltbundesamt, 1995) reflect these facts as well (Figure 1).

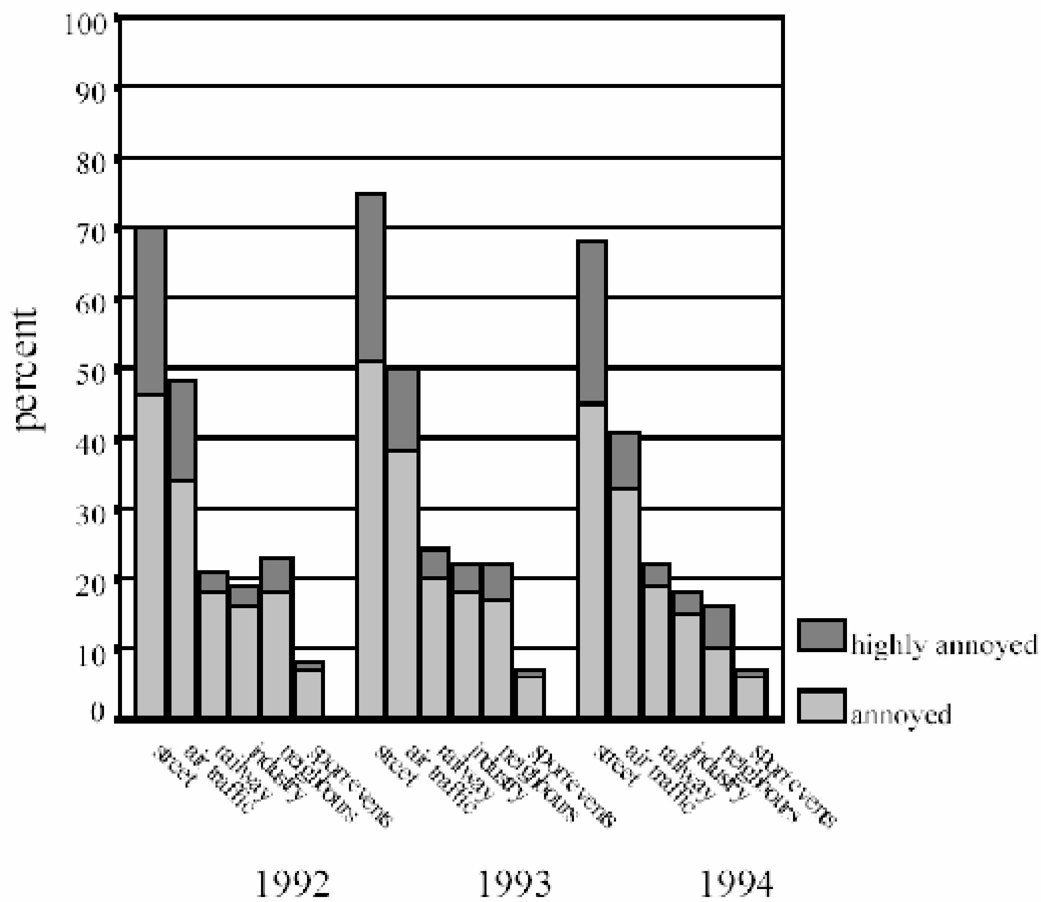

Figure 1: Percentage of German population annoyed and highly annoyed due to different noise sources 1992-1994 (Umweltbundesamt, 1995)

In 1994, 41 percent of the German population was annoyed by aircraft noise. Although this percentage decreased compared to 1992/3, aircraft are the second prominent sources of noise annoyance after road traffic. The decrease can be traced back to the technical development of the aircraft described above. Yet, it has to be considered that the need and the desire for mobility are increasing further. Thus, the increasing air traffic volume partly spoils the emission reduction due to technical improvements.

The fact that still so many people are affected by aircraft noise plus a growing desire for quietness might be one reason that, irrespective of all action taken to improve the situation of residents, they feel more annoyed than 40 years ago (Bröer & Wirth, 2004; Guski, 2003). Psychological processes in the generation of noise annoyance will be discussed more detailed in chapter 2.5.3.7.

Annoyance is a very widespread and common effect of aircraft noise. That is why this issue is so important to deal with. However, the correlation between noise and annoyance is rather modest (Guski, 1987). The existence of residents exposed to relatively low noise levels feeling highly annoyed has been reported by various researchers (e.g. Fidell, Silvati & Haboly, 2002; Hatfield, Job, Faunce, Carter, Peploe, Taylor, & Morrell, 2002). Also the opposite effect can be found: residents not feeling annoyed, but living in areas with very high noise levels (Kastner & Hagemann, 2002). The graph of Fidell, Barber and Schultz (1991) in Figure 2 visualises the huge variation in the dose-response-relationship.

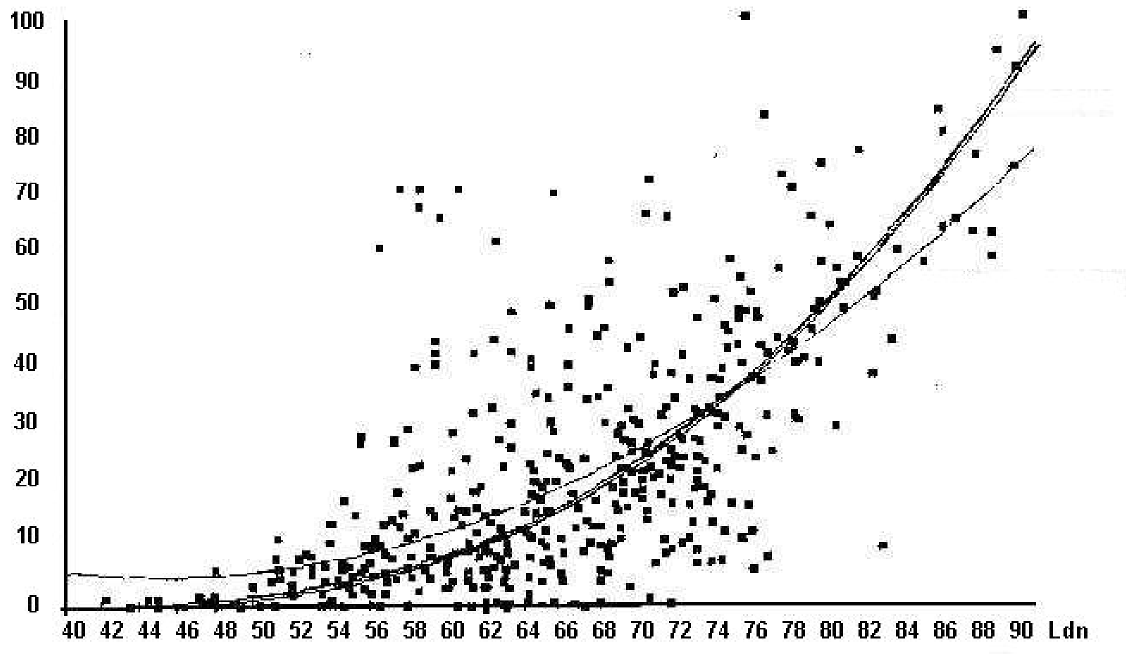

Figure 2: Mean percentage of highly annoyed residents as a function of the average day-night sound level Ldn (modified according to Fidell et al., 1991).

When looking at this graph it becomes apparent that annoyance is dependent on more than just noise levels. Various studies found that noise level could only explain between 7 and 36 % of the variance (e.g. Höger & Linz, 1992; Becher et al. 1997; Vincent, Vallet, Olivier & Paque, 2000). Research has tried to identify so called non-acoustic moderator variables (cf. chapter 2.5.4), which could explain the remaining variance.

The fact that in spite of quieter aircraft and noise abatement procedures residents seem to be more annoyed than some decades ago– referring to Bröer and Wirth (2004) – might be due to psychosocial processes such as sensitisation, altered expectations, and increasing mistrust in technology and politics.

In order to reduce annoyance considering these facts we have to strike a new path. Many times it is rather the lack of transparency and the kind of information policy that make sound events annoying (Department of Transport and Regional Services, 2000). The role of lacking transparency and information policy has been investigated in organisational psychology with a focus on developing corporate identity, organisational climate, and facilitating change. Transferring the experiences with workforce-management interactions in organisational development to the socio-organisational interface of residents and air traffic service providers can contribute a lot to improve the social climate around airports. Therefore, the thesis applies concepts of (organisational) psychology to air traffic management (ATM) in the broad sense and to the relation of airports to their residents in the strict sense. As a tool to improve the interface of airports and residents, a telephone service, the so-called NoiseCall, was developed and installed as a service and complaint communication instrument.

1.2 Structure of the research

The studies described in the thesis at hand apply concepts and theories of organisational psychology to the ATM context. The common instrument of noise lines in use at some airports (e.g. run by the airport management or a PR company) has been developed and modified for a study at Dortmund Airport by Vogt et al. (1998). The so called NoiseCall was put into practice by the University of Dortmund to provide an independent instrument to manage the interface of airport and residents. For the studies described in this thesis the NoiseCall was offered to German regional airports (Dortmund, Augsburg, Kassel). The NoiseCall provided information and ensured transparency in order to meet the demands of both residents and airport management: the NoiseCall was supposed to serve as an instrument and platform for information for both groups. It is meant as an avenue for residents to air their concern and provide them with information, to give feedback to the airport management about noise problems and finally to reduce annoyance and improve the residents' contentment with the noise management.

The author of the thesis has been involved in planning and conducting the studies and the NoiseCall service at Dortmund, Augsburg and Kassel.

As a result of the first group of studies and from the literature, the second part of the thesis has been deduced. Literature reveals (e.g. Flindell & Stallen, 1999; Guski, 1999) that the personality of residents influences their feeling of annoyance on the one hand and their expression of annoyance on the other. In order to modify and improve the interface of airport and residents appropriately, the aspect of personality needs to be considered. The fact that a lot of annoyed residents did not make use of the NoiseCall initialised the investigation of personal preferences and individual differences to handle annoyance. Therefore, the second part of the thesis will deal with the personality of residents and will focus on anger expression (Bongard & al'Absi, 2003; 2005).

The second part of the thesis is supported by data obtained in Sydney. The Sydney study has been conducted within the framework of a DAAD scholarship (Deutscher Akademischer Austauschdienst – German Academic Exchange Service) in co-operation with the University of Sydney (Prof. R.F.S. Job and Dr. J. Hatfield). The work has also been kindly supported by the Erich-Becker-Foundation.

The thesis follows this logical thread:

The interface of airports and residents and its importance are described. The aspect of noise is highlighted and the consequences of noise for both parties, aviation service providers and residents, who suffer from aircraft noise, are described. Noise effects are outlined and the importance of non-acoustic factors is stressed. The NoiseCall as an instrument to design the interface, to reduce annoyance and enhance contentment with the noise management is derived.

In the first part of the thesis, the influence of the NoiseCall on annoyance and on the contentment with the airport's and politicians' noise management is investigated at two different airports (Augsburg, Kassel).

In the second part, the role of personality is investigated. In Dortmund, users as well as non-users were interviewed and investigated with respect to their personality. In Sydney, a sample, which had used the local complaints line, was recruited in co-operation with Airservices Australia. Control subjects were acquired from the phonebook. Both groups were interviewed about their experiences concerning aircraft noise and investigated with respect to their personality.

2 Theories

Before dealing with the interface of residents and airport specifically, interfaces in general and in the context of air traffic are defined.

2.1 Definition of interface

The Oxford Advanced Learner's Dictionary (Cowie, 1994) defines "interface" as:

1. Surface common to two areas.
2. (*computing*) Electrical circuit linking one device with another and enabling data coded in one format to be transmitted in another.
3. (*figurative*) Place where two subjects etc. meet and affect each other: at the interface of art and sciences.

The Merriam-Webster online dictionary (Merriam-Webster, www.m-w.com) defines "interfaces" as such:

1. Surface forming a common boundary of two bodies, spaces, or phases: an oil-water interface.
2. a: The place at which independent and often unrelated systems meet and act on or communicate with each other: the man-machine interface.
   b: The means by which interaction or communication is achieved at an interface.

Interface can therefore be generally understood as point of contact, as e.g. two systems meeting, which might have nothing in common but one aspect that forces them to communicate with each other.

2.2 Interfaces in air traffic organisation

Thinking about air traffic, plenty of interfaces come into mind: inter-organisational co-operation between airlines, airports, and air traffic control services. The interface with the environment is very obvious and of increasing concern (as already mentioned in the introductory chapter 1.1).

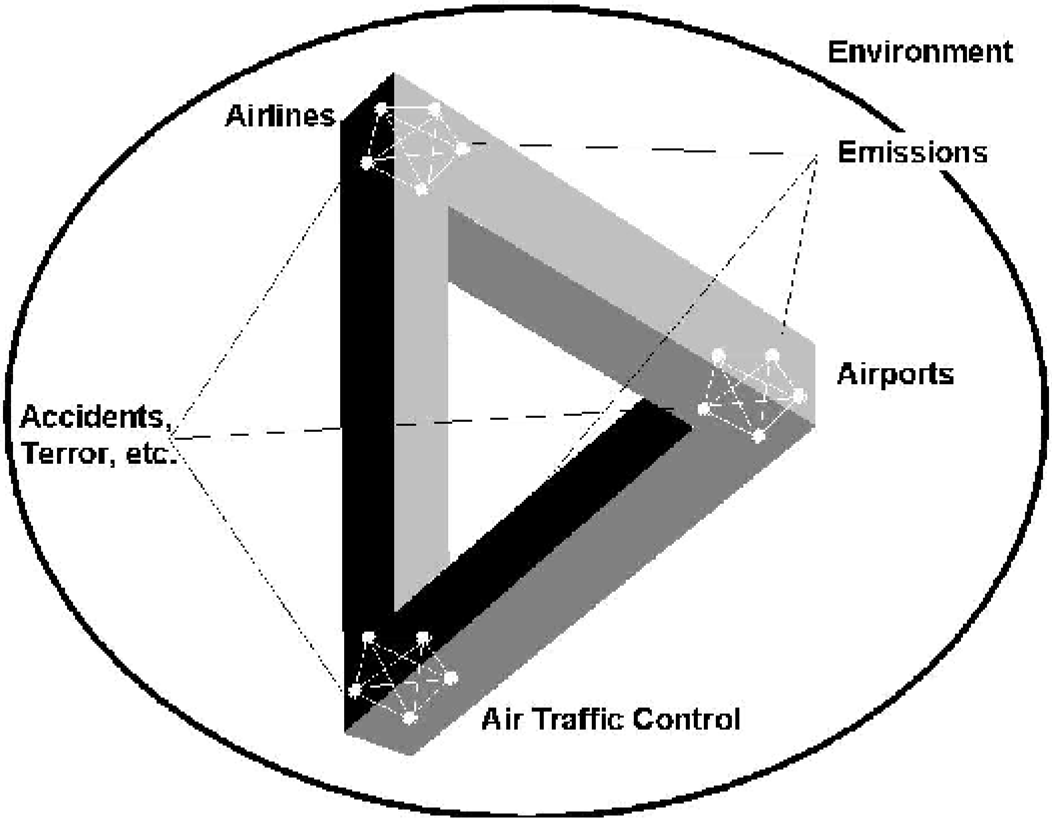

Figure 3: Interfaces in air traffic (Vogt & Kastner, 2003)

Figure 3 visualises the different interfaces within air traffic management (ATM):

- Pentagons: within and between each protagonist
- Triangle: between airlines, airports, and air traffic control
- Pyramids: within society
- Circle: environment

The factors of security and safety exemplify one interface within and between the organisations (pentagon), e.g. an airport. They have a significant impact on annoyance because some part of it is due to the fear of aircraft crashes in the vicinity of airports. Security refers to the shielding of sensitive areas from outside dangers. Safety refers to ensuring safe air traffic within the airport with the highest possible efficiency (Birenheide, 2003). Both fields have to respect and meet a number of legal duties. Therefore, also legal authorities are regarded as partners of airports besides airlines, air traffic control services, and national and international institutions (triangle). Birenheide (2003) delineates the conflict between economic interests, quick passenger check-in, and low costs on the one hand, and security and safety requirements on the other hand.

In aviation, safety and security have to be the first priorities and hesitating in taking preventive measures or interventions can be fatal. Consequently, smoothly operating interfaces are an issue of highest importance in aviation. Air service providers, airlines etc. have already put a lot of effort in providing highest security and safety.

This work focuses on the pyramids: the interface between air traffic and society is investigated and designed.

2.3 Why is the interface of airport and residents so important?

Even though the air traffic system is highly complex and dynamic and demands high involvement in terms of quality, safety and security, the socio-organisational interface between air traffic organisations and society is not to be ignored for a variety of reasons.

Especially thinking about noise, the different perspectives or in other words the different systems' points of view have to be considered. From the point of view of the affected residents, aviation and the resulting noise is a nuisance. From their point of view noise abatement procedures should be enforced (Wirtz, 2003). However, from the point of view of service providers, noise is simply not relevant in terms of safety and merely a by-product of their business. At a first glance, noise abatement procedures cost money and might reduce the potential profits. Therefore, airports invest rarely in voluntary noise abatement. In the next section (2.4), it will be outlined why this is short-sighted with respect to sustainable development. Yet, it should be kept in mind that nobody deliberately increases noise. Every party is interested in noise abatement, but when it comes to costs and a reduction of comfort, aviation organisations and passengers are not always willing to meet the requirements of noise suffering residents. Being a customer of air traffic, noise is accepted in a totally different dimension then in a private context e.g. during recreational times. Additionally, customers are exposed to noise for only a short and foreseeable period of time, which is exactly the opposite of the residents' situation. It becomes apparent that it is highly dependent on the point of view and the adherent prospect, how noise and noise abatement is judged and assessed.

In the following sections, reasons will be described in detail, why the interface of air traffic and residents is not to be neglected, why it is important to consider its design, and what advantages this has for all parties.

2.4 Noise at socio-economic and organisational level

In the view of airports and local authorities noise abatement measures are costly. For them it is questionable whether the social benefits justify the high costs. Navrud (2002) stresses the importance to find out the social benefits of reduced noise as it can justify the high costs for the implementation of noise reduction measures. Knowing the social costs of noise and the social benefit of reduced noise would help to motivate authorities to enforce noise abatement laws or even better to convince aviation organisations to voluntarily invest in noise abatement. Recently, several authors have claimed the necessity and proven the possibility of investment analysis methods for these so-called soft factors matching the existing controlling instruments for technological investments (hard facts) (Köper & Vogt, 2003; Köper, Pennig, Vogt, 2003; 2004; Pennig, Leonhardt & Maziul, 2004).

Airports are in the focus of the public discussion on aircraft noise and protective measures. If a certain noise exposure is exceeded they have to provide noise insulated windows to the residents for example. However, abatement measures can be implemented not only between source and receiver but also at the source (e.g. aircraft engine exhausts) and at the receiver (e.g. ear plugs). Besides technical measures also planning and administrative procedures can reduce noise exposure of residents.

Noise reduction at the source is considered as **primary** noise control, implemented via

- the development of low-emission aircraft,

- the modification of sound generation (e.g. so-called bypass-engines),
- a change in the way the noise spreads,
- technical measures directly at the source (e.g. noise absorbing coating or installation of a sound absorber),
- active measures to influence the noise (e.g. addition of sound components to reduce tonal engine noise).

Secondary noise control (passive) is implemented between noise source and receiver via noise protection walls or windows. Noise insulation when warming up the engines is another example of secondary noise control. The problem with secondary noise control – for example thinking about insulation windows – is the impairment of living quality as the windows need to be shut to keep the noise away.

Operational measures are another category of noise control (Ising & Költzsch, 2004). Noise reduced approach and departure procedures, as well as political decisions and administrative abatement concepts such as approach and departure fees depending on the noise levels, night flight restrictions or night curfews, or administrative relocation of the traffic, and level to frequency conversion are considered operational measures.

Psychological noise control includes for example free noise lines and an improved information policy.

Generally, active noise control should be the priority in noise abatement. However, noise levels are not the only factor for negative noise effects as will be shown in chapter 2.5.4. Guski (2005) states that noise is primarily a psychological problem, which depends on personal experiences, the assessment of the noise source, and the feeling of control. Therefore, non-acoustical measures will be very important in the future (Flindell & Witter, 1999; Job & Hatfield, 2000; Vogt & Kastner, 2000). The acoustical measures should be accompanied and enforced by non-acoustic measures.

Already in the 1980s the costs of environmental opposition in Germany, for example against the extension of airports, were estimated up to 50 million Euros (Wiesner, 1984). Bunnell (1991) points out that public opposition has been identified as the major constraint with unknown costs in airport extensions. Noise obviously has become a major public relations problem. Guski (2003) adds that airport residents oppose noise stronger than residents affected by car noise, which might be due to breaking territory boundaries (fly overs) and aircraft noise being very invasive. The costs of public opposition and prevented airport extensions as well as the suffering of the residents and the subsequent health costs for the national economy are increasing. For example the costs for treatments of noise induced hearing loss sum up to 250 million Euros per year (Ortscheid, 2005).

At the moment, it seems quite difficult to calculate the "cost of noise". It depends heavily upon government regulation and community perception (Iemma, Diez & Morino, 2005). However, there are some methods to assess the costs and benefits of noise abatement. Navrud (2002) mentions the Damage Function Approach (DFA), valuation techniques (Hedonic Pricing vs. Contingent Valuation; Choice Experiments), and Benefit Transfer Techniques. Navrud (2002) concludes that the literature on noise valuation is extensive and provides a wide range of damage estimates in different forms of measurement. Overall, there is a great variance in the results of European studies:

- 45-90 Euro per decibel per household per year
- 0.08-2.30% change in property price per decibel

Navrud (2002) considers the studies as useful benchmarks to estimate the external costs of noise. In order to make a point about the “costs of noise” the studies should extend their range and include not only the effects in the home, but also the expose costs at work and at leisure. Otherwise the effects of noise pollution are underestimated. Navrud also points out that the studies differ in the methodology, sampling, and their assumptions about baseline noise levels, which ought to be considered.

It is important to stress the financial benefit of measures like noise abatement. A promising approach (cf. above), which has so far been applied to different soft factor programmes, has been developed by Köper, Pennig and Vogt (2003, 2004). The model is based upon following idea: The proof of effectiveness and efficiency for soft factor interventions can only be produced, if the evaluation is taken into account during conception, design and implementation of single process steps. In the sense of controlling, the cost-benefit-analysis can be understood as a regulation circle of control activities in the field of the soft factor

management. This control circle comprises planning and decision, organisation and implementation as well as evaluation and optimisation. According to the model the benefits of soft factors can be assessed.
The mentioned ways to reduce noise are not the only potential abatement areas. Because there are non-acoustical factors, which modify the noise effects, they can as well be used. Factors like the trust in the airport management or noise regulating authorities, the communication between the involved parties, the past experiences between residents and airport management are of major importance. These factors will be discussed in chapter 2.5.4.

2.5 Noise at the individual level

The previous section outlined the consequences of noise and its abatement for the airports and the national economy. Noise and its abatement, of course, have quite a different meaning or priority for residents. The thesis tries to integrate both sides of the medal, because from each point of view all parties are understandable. The thesis tries to highlight that all parties can profit if they work together.

In this chapter first of all the physical background of noise is outlined. Subsequently, the effects of noise for residents are described referring to medical, economic, social, and psychological aspects. The psychological consequences of noise are focused upon. Also, different stress theories are highlighted in order to understand how the psychological consequences can be tackled. Finally, a psychological model of noise and its effect is discussed.

2.5.1 Noise as civilisation problem

The following citations make it obvious that it is sensations, circumstances, and associations that play a vital role in the assessment of sound.

"Our ear is choosy and unrestrained subjective. A thundering waterfall puts us in a good mood. A dropping water tap drives us nuts." (translated from Lehmann, 1998)

Lehmann (1998) also states that in terms of sound measuring a four-lane main road does not differ from Tschaikowksy's Nussknacker-suite. This subjectivity, which turns sound into noise, also makes it difficult to define "noise". Yet, in spite of all variability, there is consensus that noise is not only loud sound, but any unwanted sound or sound event, which affected people assess negatively. Such an understanding of noise focuses not only on the physical conditions, but also the individual sensations. However, noise can have unwanted effects, which are not even obvious to the affected person. Therefore, Guski (1987) adds that sound is considered noise in case a person is affected psychologically, physically, socially, or economically.

Noise depicts a major issue in society as humans are exposed to noise more and more and at the same time their demand for a high quality of living is increasing. But not only today's society has to deal with noise: Kant and Goethe felt that noise is an unbearable strain, Schopenhauer describes it as pest of all thinking beings, and von Katz calls it one of the faces of Lucifer (Vester, 1976). In former times, noise constituted an acoustical signal for an immediate battle people could regenerate from afterwards. Sound served as a warning system for dangers, by processing the intensities and the frequencies in the central nervous system (Rylander, 2004). Now it has become a permanent alarm sound (Vester, 1976) without subsequent physical action e.g. escape or battle. In this respect noise does not fulfil any biological purpose anymore. However, as noise does still provoke respective processes of the body, it has negative effects and thus causes similar problems like stress in general (Vester, 1976). These effects are outlined in chapter 2.5.3 after an introduction about the physical facts on noise.

2.5.2 Physical facts

In this section, the physical facts about noise are briefly outlined in order to make an understanding of the influencing factors easier.

The main objective of noise research is to detect and determine critical limits and dose-response-relationships in order to predict and prevent adverse noise effects.

From the physical point of view, noise is nothing else than sound waves, which spread in space (Seidel, 1996). Sound results from the oscillatory motion or vibration of an object; the motion is transferred to the surrounding medium (air, solid, liquid, gas). Sound can be defined as a fluctuation of pressure (acoustical oscillation) and its waves are local changes of air pressure.

The physical parameters (frequency, amplitude) are defined as follows:

The **frequency** equals the number of repetitions of a wave per second expressed in hertz (Hz) with one Hz being one wave per second: the higher the number of repetitions the higher the pitch. The **amplitude** equals the extent of air pressure variation: the higher the amplitude the louder the sound. The measuring unit of the pressure is the pascal; the intensity of the sound is measured in watt per square meter (w/m^2) (Brambilla, 2001). The human ear is able to perceive air waves between 20 and 20000 Hz, yet the highest sensitivity of the human auditory system can be located between 500 and 5000 Hz. This area is most important for understanding speech. Due to the huge dynamic range of the auditory system, it is convenient to use a logarithmic scale quantifying the ratio of two intensities instead of dealing with sound intensities directly (Guski, 1987). Therefore, the intensity that needs to be measured (I) is related to a reference point. This reference point consists of the intensity threshold (I_0) that equals the required sound pressure to perceive 1000 Hz. The ratio (I/I_0) is logarithmised (bel) and multiplied by 10 (decibel, dB). Therefore, the sound intensity level in dB (decibel) is defined as:

$$L = 10 \log I/I_0 \text{ [dB]}$$

The decibel scale (dB) ranges from the hearing threshold at 1000 Hz (0 dB) up to the threshold of pain at approximately 140 dB (Guski, 1987). The logarithm has to be taken into account when assessing sound levels: for example + 3 dB means a doubling, - 3 dB a bisection and + 10 dB a tenfold increase of the sound intensity (Kastner, 2001).

The difference in sensitivity described above, means at the same time that sounds with different frequencies have to differ in their objective energy in order to be perceived as equal in loudness. Filters account for the fact that the auditory system differs in its susceptibility to frequencies. These filters assess specific frequencies stronger than others. The A-filter is the most common one, which tries to simulate the susceptibility of the human auditory system at low and moderate intensities. Frequencies under 1000 Hz as well as frequencies above 4000 Hz are attenuated. The intensity of so called A-weighted sounds is given in dB(A). Other filters have been developed for high and very high intensities, which are not as wide-spread as the A-weighting.

The (A-weighted) equivalent continuous sound pressure level Leq in dB(A) is an indicator of noise, which averages many measurements of a particular sound taken at different times over an extended period of time. This integrating noise index is used to assess long lasting sounds, which fluctuate in their noise level. Leq is just one of the many integrating noise indices. However, Kalveram (1995) states that the indices correlate to a very high degree and that they are interchangeable in terms of their prediction of human responses to noise (see also Vallet, Pachiaudi, Depitre, Tanguy & Francois, 1988).

Continuous sound levels are, however, not appropriate to describe short and intensive noise events as, for example, generated by aircraft take-offs. For this purpose the average maximum noise level Lmax is used. Lmax is calculated by the arithmetic average of all single maximum noise levels. Loud noise events can be assessed more appropriately by the means of Lmax, and therefore sleep disturbances for example can be judged more detailed (Kastner, 2001).

To get an idea of different sound intensities of environmental sounds see Figure 4 for some examples.

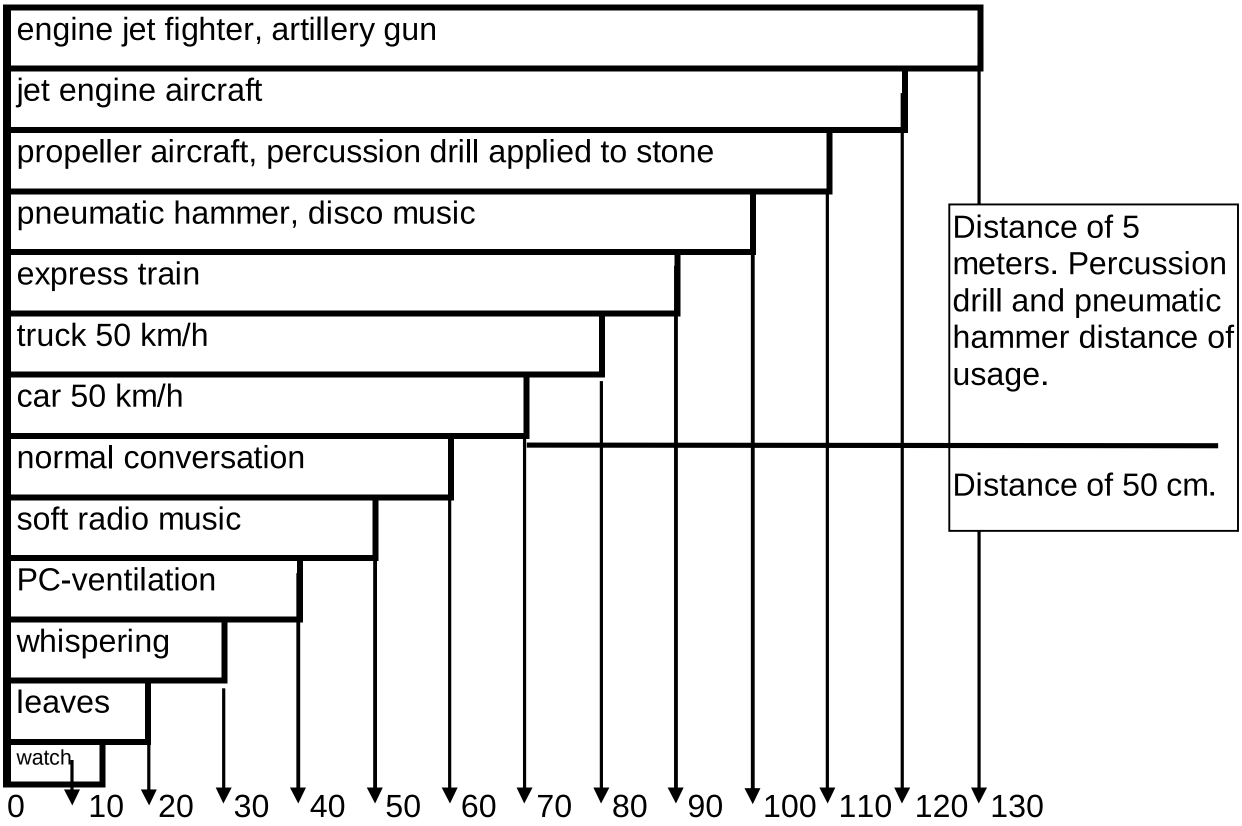

Figure 4: Sound level of typical sounds in dB(A). (Note: 10-20 dB(A): leaves at soft wind, ticking of watch)

2.5.3 Effects of noise

Even though the perception of sound is of importance for the human well-being in their every day life – e.g. communication, music, bird song – this section will deal with the adverse effects of sound (noise). The significance of noise pollution is given in this chapter under separate headings, according to the specific effects: medical, economic, social, and psychological effects. The focus lies upon the description of the psychological effects.

2.5.3.1 Medical effects of noise

Noise is associated with a number of health problems. Research focuses on noise induced hearing loss, changes in the circulatory system, effects on sleep, and psychiatric symptoms as major medical effects of noise (Guski, 1987).
In this section five areas are differentiated: aural effects (damage to hearing), extra-aural (mainly cardiovascular) effects, psychiatric disorders, sleep disorders, and the impairment of mental development. Annoyance is a psychological noise effect. The Health Council of the Netherlands (1999) draws the conclusion that some somatic effects are directly linked to aircraft noise, whereas others are rather linked to annoyance.

2.5.3.1.1 Aural effects

Hearing impairment (aural effects) is typically defined as an increase in the threshold of hearing. Noise-induced hearing impairment is the most prevalent irreversible occupational hazard. In the developing countries, not only occupational noise, but also environmental noise is an increasing risk factor for hearing impairment (WHO, 1999). An exposure to noise levels above 80 dB(A) for a few hours can cause a temporary threshold shift (TTS). Whether the hearing organ recovers depends on the noise level and the exposure time. The fewer the breaks between the single noise events, the higher is the probability of a hearing impairment. Due to high noise levels, extended exposure times and/or too short recovery periods, a permanent threshold shift (PTS) can occur. This hearing loss is usually located in the outer hair cells of the inner ear. Due to the overstrain, an impairment of the permeability of the cell membrane leads to cell death. The International Organisation for Standardisation ISO (1990) states that noise-induced hearing impairment occurs predominantly in the high-frequency range of 3000 to 6000 Hz, the effect being largest at 4000 Hz. With increasing noise level and increasing exposure time, noise-induced hearing impairment also occurs at 2000 Hz. An Leq of 85 dB(A) is seen as the threshold for a beginning risk, and due to German law, employers have to provide protection measures at higher levels (Jansen & Haas, 1991).

2.5.3.1.2 Extra-aural effects

Cardiovascular risks take the first position in the category of extra-aural effects. While aural effects can be observed from average noise levels of 85 dB(A) and higher, damage to the cardiovascular system cannot be excluded at noise levels of 75 dB(A). Noise and the resulting stress depict a risk factor for high blood pressure and coronary heart disease (e.g. Rylander, 2004). Noise is a stressor (Ising & Kruppa, 1996), which causes stress reactions via the sympathetic-adrenal-medullary and the pituitary-adrenal-cortical axes (Ising & Kruppa, 1996). Noise causes the hormones adrenaline and noradrenaline to rise, which again leads to a constriction of the arterioles in the body periphery. The constriction causes a rise of the blood pressure (Jansen, Griefahn, Gros & Rehm, 1981). The relation between noise and extra-aural effects was only traced back to noise at the workplace. There have been studies on health effects of aircraft noise, but the causal relationship could not be proved consistently. Probably due to lower exposure levels compared to industrial settings and more complex psychological processing, the association of traffic noise exposure and cardiovascular risks is not that clear. The majority of epidemiological traffic noise studies found only a tendency of measured hypertension increasing with environmental noise level (DFG, 1974; Knipschild & Salle, 1979; Herbold et al., 1989; Babisch et al., 1993; Elwood et al., 1993). Therefore, average noise levels of 65 dB(A) could not be proved to be a direct, pathogenic factor. Nevertheless, Babisch (2000) considers noise a risk factor, especially for indirect damage through maladaptive coping. It is probable that health impairments are not solely dependent on noise, but are also affected by the subjective assessment of noise.

2.5.3.1.3 Mental health

Environmental noise is not believed to be a direct cause of mental illness, but it is assumed that it accelerates and intensifies the development of latent mental disorders. Since the 1960s it is assumed that residential areas exposed to more than 90 dB(A) maximum noise levels count more admissions with psychiatric disorders than residential areas with less aircraft noise. Noise levels do not solely coincide with psychiatric disorders, but also add to the use of sedatives (Stansfeld, Haines, Burr, Berry & Lercher, 2000). Studies on the adverse effects of environmental noise on mental health cover a variety of symptoms, including anxiety, emotional stress, nervous complaints, nausea, headaches, sexual impotency, changes in mood, increase in social conflicts as well as general psychiatric disorders such as neurosis, psychosis and hysteria. Studies often revealed different or even contradictory results. This might also be due to the problems in selecting independent, dependent and intervening variables. In most studies, however, a tendency was found for the relation of noise and psychiatric disorders. Abey-Wickrama et al. (1969) found a (weak) relation of aircraft noise and psychiatric disorders of women. Stansfeld, Clark, Jenkins and Tarnopolsky (1985) reported a relation between diagnosed symptoms and noise sensitivity, which applied to women in noise exposed areas. Gattoni and Tarnopolsky (1973) detected effects of noise for men: Men living in noise affected areas were treated more often for neurosis, psychopathic, organic and affective disorders. Obviously, mental health is influenced by other factors than noise. Nevertheless, there seems to be a relation with annoyance, anger, and anxiety as the most important mediators. Many other risk factors are mixed up with the noise exposed living environment, e. g. unemployment and alcohol consumption etc. Stansfeld et al. (2000) conclude that especially high noise levels above 90 dB(A) are a risk for psychiatric disease and drug misuse. Even though it is still not clear, how noise and psychiatric disorders are linked, the results suggest some kind of relationship. The exact interactions should be investigated in more detail.

2.5.3.1.4 Sleep

Uninterrupted sleep is known as a necessity for good physiological and mental health. There has been plenty of research on the effects of noise on sleep. However, most of the conducted studies are experimental ones in controlled environments, whereas field studies conducted with people in their normal living situations are scarce. Most of the more recent field research on sleep disturbance has been conducted for aircraft noise (Fidell et al., 1995; Horne et al. 1994; WHO, 2003).

The primary sleep disturbance effects are: Difficulties to find sleep, sudden awakening during the night, differences in the sleep quality, and changes in the sleep cycle. The exposure to noise during the sleep over a long period of time can result in chronic sleep deficits, chronic fatigue, and exhaustion with the long-term consequence of a reduced quality of life.

The following were used as indicator variables: disturbed sleep, awakenings, body movements, sleep stage shifts, cardiovascular and EEG-responses as well as after-effects (e.g. perceived sleep quality, increased fatigue, depressed mood or well-being, decreased performance).

As far as the after-effects are concerned, Jürriens et al. (1983) reported less relaxing sleep and more fatigue, headaches, inactivity, introversion, or irritations during daytime for the subjects as well as an increase of reaction times. Subjective after-effects (self reported sleep quality) have been found to correlate moderately with physiological measures (Terzano et al., 1990).

Referring to the investigation of awakening levels Maschke et al. (2001) re-analysed old data. The results give evidence that the average human already wakes up at levels between 45 to 50 dB(A) and not at 60 dB(A) as commonly believed before the re-analysis. In contrast to cardiovascular and EEG responses, subjects often can habituate their awakening threshold (Öhrström, 2000). Other indicators used in recent studies are stress hormones: increased cortisol excretion was found already at maximum noise levels of 55 and average noise levels of 30 dB(A) (Ising and Braun, 2000). Long term effects of this stress-induced humoral response have to be discovered in future research.

For a good sleep the noise in the bedroom should not exceed 37 to 40 dB(A). This threshold applies to continuous noise. For intermittent noise, however, the maximum level at the ear should not exceed 53 dB(A) in order to avoid awakenings, and should not exceed 47 dB(A) to protect minor sleep alterations (Griefahn, 1990). The World Health Organisation WHO even claims an Leq of 30 dB(A) indoors for continuous noise as a threshold to avoid negative effects on sleep. Moreover, WHO (2003) demands even lower limits and a reduced frequency of noise events for sensitive people (like children).

2.5.3.2 Impairment of mental and motor task performance

The impairment of mental and motor task performance depicts another category of noise effects. Noise can drown important acoustic signals and block processing capacities, but noise can also be supportive for mental tasks, for example, by masking irrelevant and distracting sounds and stimulating the listener (e.g. by music) (Kastner & Vogt, 2000). To enlighten the relation of noise and the change of performance, Wilding, Mohindra and Breen-Lewis (1982) exposed subjects to noise levels of 65 dB(A), 70 dB(A) and 85 dB(A). Afterwards a memory test was conducted. The authors report a decrease of performance for the semantic processing only at noise levels of 85 dB(A). The performance referring to free association, however, was increased. Performance in mathematical tasks was not impaired by noise as Lundquist, Holmberg and Landström (2000) showed. Moch and Maramotti (1993) exposed subjects to sporadic noise levels of 90 dB(A) showing an impairment of performance referring to reaction time and accuracy.

As far as the effects of noise on motor function are concerned, the time of day and the difficulty of the task are of importance. Jäncke, Musial, Vogt and Kalveram (1994) presented a radio sound during a task. Subjects solved easy tasks better in the mornings compared to the afternoon (activation). The performance of difficult tasks was decreased by radio sound at any time of the day.

Guski (2003) reports about methodological controlled studies at Heathrow, where at least a decreased reading performance was detected for school children chronically exposed to Leq levels above 66 dB(A). He stresses the relation of noise load and social status (cf. chapter 2.5.6).

In summary, research has put forth different results. Performance can be maintained or even improved under noisy conditions, but only with easy tasks or increased effort. That is why, sometimes exhaustion and an impairment of performance could be detected after task performance during noise exposure (Glass & Singer, 1972; Broadbent, 1980; Evans et al., 1993).

2.5.3.3 Legislative countermeasures

The discussed effects ought to be excluded by the various laws and thresholds. Unfortunately, the German law for the protection against aviation noise is antiquated as it dates from 1971. An amendment has been discussed for many years. The latest development was a hearing in September 2004, which entailed new statements and objections. It is not clear, when the amendment will be valid law. Meanwhile, in every German airport extension legal proceeding single medical effects of noise are considered in order to protect the population. WHO (2003) declares immediate damage to the auditory and cardiovascular system cannot be excluded after long-term exposure to average daytime sound levels of 80 and 70 dB(A), respectively. Measures have to be taken if these critical limits are reached or exceeded (e.g. European Directive 2003/10/EC for exposure at work). However, even below the mentioned thresholds noise may facilitate stress responses and annoyance which can make people ill. Figure 5 indicates there is no clear threshold for unhealthy noise levels. Below 50 dB(A) daytime average noise level Leq (in the street) and 47 dB(A) nocturnal maximum noise level Lmax (at the ear) noise levels are definitely not health threatening. 55 dB(A) daytime Leq causes some annoyance and also cardiovascular responses and therefore can be seen as the threshold to disease.

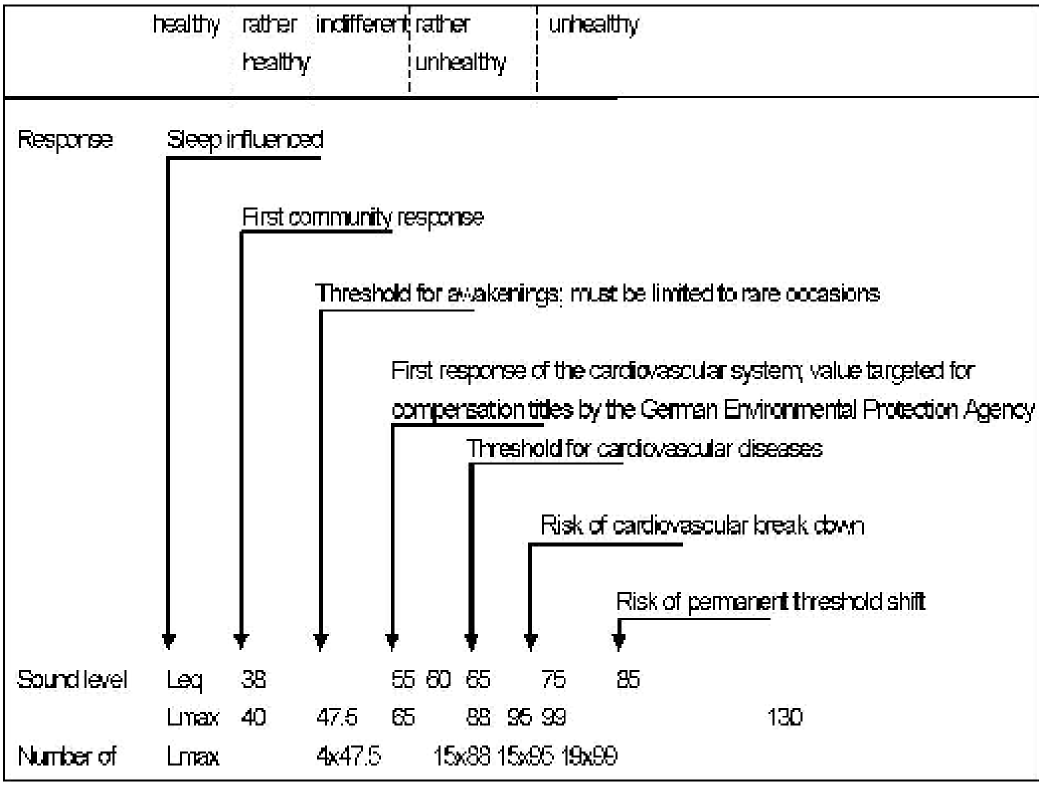

Figure 5 **Responses to average (Leq) and numbers of maximum (Lmax) sound levels and their health relevance. Only sleep related values are referred to as inside the house (Figure from Vogt, 2002).**

2.5.3.4 Summary

Excessive sound levels can directly cause damage to human health. Exposure to high intensity sound (Lmax>100 dB(A)) is a leading cause of damage to sensory ("hair") cells. Prolonged exposure to sounds above Leq 85 dB(A) may cause permanent hearing loss. Indirect medical effects can hardly be traced back to noise as it constitutes just one among other factors. Nevertheless, the factor of noise is known to cause e.g. an increase in blood pressure in interaction with other stressors (Vogt & Kastner, 1999). This is especially true if the person feels powerless and not able to change the situation (cf. chapter 2.5.4). Keeping the citation mentioned at the beginning of chapter 2.5.1 in mind, the assessment of noise is subjective. It is this subjectivity that needs to be taken into account in order to reduce the negative effects of noise (cf. chapter 2.5.6).

A coherent answer to the question of effects of long-term noise exposure on health is still missing (De Jong, 1993). Moreover, noise seems to affect health via stress-inducing moderators. These moderators will be discussed in chapters 2.5.4 and 2.5.5.

Facts applying to physical health are also true for mental health: noise contributes to mental impairments in combination with other factors (Bell, Greene, Fisher & Baum, 2001; Guski, 1987). The concepts of perceived control and learned helplessness play a major role in the area of mental disorders (Bell et al., 2001). Both concepts will be discussed in chapter 2.5.4 together with other non-acoustical factors, which influence the effects of noise.

2.5.3.5 Economic effects of noise

Economic effects of noise include direct as well as indirect influences on land prices, lease prices, and other factors that can be assessed monetarily. The rent in a residential area affected by aircraft noise might decrease due to the increased noise levels. In a less affected residential area the rent may increase: Wealthy people are able to afford the demanded prices.

At the meeting of the Federal Association against Aircraft Noise (BVF - Bundesvereinigung gegen Fluglärm) Guski (2003) pointed out that road traffic induces a loss in the value of the real estate with increasing noise levels. As a consequence well-off residents move to quieter areas and unprivileged residents on the contrary will stay or will even move to these highly exposed areas because living is affordable there. So called noise ghettos evolve. This is not only an economic effect of noise, but also a social one, which is investigated in the next section more closely.

Navrud (2002) describes the different valuation techniques such as stated preference (SP) and revealed preference (RP) to estimate the economic value of changes in noise levels. The revealed preference approach of hedonic price (HP) has been applied by most of the economic studies. The HP approach analyses how differences in property prices reflect the individuals' willingness-to-pay (WTP) for lower noise levels (Navrud, 2002).

Guski (2003) states that for aircraft noise similar economic and social effects are assumed. But, as yet, this could not be proven. Also it has to be considered that the residents' resistance against aircraft noise is stronger than against road noise because the latter is produced by (nearly) everybody. Navrud (2002) cites studies that identify willingness-to-pay (WTP) data for aircraft noise ranging from 8 Euro up to 959 Euro (per dB per household per year). Noise exposure, noise annoyance as well as non-acoustic variables (e.g. education, noise sensitivity) affect the WTP data.

2.5.3.6 Social effects of noise

Some obvious effects of noise on social life are for example the impairment of communication. This is a very invasive effect as it causes residents to avoid using the yard, terrace, or balcony or even to move away due to noise. These possible effects clearly underline the degree to which the life quality can be restricted by noise.

The influence of noise is apparent on the social level: communication defined as social situation between two or more people is impaired by noise. Of course, raising the voice or moving closer to the conversation partner partly compensates for this impairment. Yet, this is only possible to a certain degree. If communication is permanently and heavily impaired by noise, one of the basic abilities becomes stunted (Guski, 1987). Noise interference with speech comprehension results in a large number of personal disabilities, handicaps and behavioural changes: e.g. problems with concentration, fatigue, uncertainty, irritation, misunderstandings, problems in human relations, and stress reactions (WHO, 2003). Speech interference is defined as a masking process: simultaneous, interfering noise makes speech not understandable. Of course, the masking effect of interfering noise in speech discrimination is more relevant for hearing-impaired people, the elderly, children in the process of language and reading acquisition, and non-native speakers (WHO, 2003).

As mentioned above, the masking effect can be overcome to a certain extend by raising the voice, which means additional strain on the side of the speaker, or the distance between speaker and recipient can be decreased. Speech intelligibility in everyday living conditions is influenced by speech level, speech pronunciation, talker-to-listener distance, sound pressure levels, and to some extent other characteristics of interfering noise, individual capabilities of the listener and the level of attention (WHO, 2003). For 30% of the affected people aircraft noise means a strong impairment of communication and for 50% some impairment at Leq of > 60 dB(A) (Spreng, 2004).

Another area of social behaviour affected by noise is altruism and aggression. Research on the effects of noise on pro-social behaviour indicates that noise decreases this behaviour (Guski, 1987). Bell et al. (2001) cite studies by Page providing evidence that noise can reduce the likelihood of helpful behaviour: people may not notice that others need help. The effects on aggressive behaviour are still debatable. Noise increased aggressive behaviour if the people exposed to noise had been provoked in advance (Donnerstein & Wilson, 1976; Geen & O'Neal, 1969; Konečni, 1975). This indicates that an aggressive tendency must prevail for other reasons, which then might manifest as behaviour under additional noise stress. Studies from the 1980ies concerning aggression and altruism made airport residents worry that noise generally causes aggression (Guski & Schönpflug, 2004). However, these worries turned out to be ungrounded (Bullinger et al., 2003, quoted in Guski & Schönpflug, 2004).

The development of so-called noise-ghettos is considered another social effect of noise. People of a higher social status and well-off people have the chance to move away from noise exposed residential areas. As noise exposed areas are cheaper and affordable, people of a lower social status stay in the exposed areas. Consequently, noise can make people move and therefore noise has social effects (Guski, 1987).

2.5.3.7 Psychological noise effects

Among the psychological effects of noise the concept of annoyance takes an exposed position. Therefore, annoyance will be the focus of this chapter.

Noise annoyance is the most studied affective reaction to sound. Schick (1997) gives a detailed review of theoretical approaches and empirical findings. In

Navrud (2002), annoyance is defined “as a feeling of resentment, displeasure, discomfort, dissatisfaction, or offence when noise interferes with someone’s thoughts, feelings or actual activities”. Annoyance is a rather global factor that characterizes the perceived impairment of a person (Höger, 1999). Noise annoyance is seen as a negative assessment of external conditions. It is difficult to narrow down the concept, but in Western societies we find some consensus that it basically consists of following features:

1) feeling of bother, trouble, and displeasure
2) impairment of intended activities (especially communication and sleep)

Guski et al. (1999) conducted a systematic analysis: noise experts defined annoyance as multidimensional, although integrative concept, including behavioural as well as evaluative components. Behavioural components are e.g. the impairment of intended activities. Evaluative components are especially the repeated (mostly continuous) exposure to noise. The decisive factor is that the sound is unwanted. The extent of annoyance is determined by sound level, but is not solely dependent on it. It is rather the non-acoustic factor of psychological stress (cf. chapter 2.5.5) that plays a major role.

The difficulty to define annoyance is partly due to the many connotations annoyance has. Guski (1997) points out that the term annoyance is used interchangeably with other words, denoting unpleasant or aversive experiences. Annoyance comprises: disturbance, aggravation, dissatisfaction, bother, displeasure, uneasiness etc. Two aspects that have been rated most similar to annoyance in an international expert study (Guski et al., 1998, 1999) are “nuisance” and “disturbance”.

According to Guski (1987) the annoyance is not a direct consequence of the noise event, but should rather be considered as an effect of the disturbance caused by the sound event: initially a person is hindered in his/her activities, the person realizes the disturbance and judges the disturbance negatively; as a consequence the person feels annoyed. Kalveram (1996) holds the opposite view: annoyance is generated by the biological reaction to the stimulus; due to the biological reaction the individual is distracted from its activities.

Both concepts assume a correlation between annoyance and the impairment of intended activities.

Noise annoyance is also understood as an affective process, which is connected to the noise source (e.g. perceived annoyance due to the fear of aircraft crashes; cf. chapter 2.2). Annoyance also relates to the attitude towards the noise source and the knowledge of the annoyed people about this source. For instance, the knowledge about effects of noise on sleep can influence annoyance (Guski et al., 1999).

The mentioned approaches ought to be a definition of annoyance, but it becomes apparent that they are rather a theoretical derivation or explanation of annoyance generation and moderation. For example the attitude towards the noise source can serve as a definition, but it is also one of the influential factors. These moderating factors will be discussed in the next section, before putting them all together in a theoretical model of annoyance.

2.5.4 Non-acoustic factors

Research on noise effects has set the goal to find groups of influential factors that are decisive for the extent of noise effects. The correlation between noise level and the extent of annoyance is .46 only (Guski, 1987). The question arises which further aspects influence the extent of noise effects. Apparently, it is not only the physical aspects of noise itself but its integration in a context of several non-acoustic factors being responsible for its effects (Schick, 1997). Therefore, apart from acoustic factors such as noise level and spectrum, non-acoustic variables have been investigated as well. The classification of non-acoustic factors is not clear-cut, as single factors can be allocated to different groups. Also, different authors delineate different sub-categories. Höger (1999) differentiates between assessment-, attitude-, and social factors. Guski (1987, 1999) differentiates between personal and social factors, and also subdivides factors of the living surrounding, factors of the noise source, situational and personal factors. This thesis considers the last classification.

2.5.4.1 Factors in the living surrounding

According to Guski (1987) factors of the living surrounding that are positively judged diminish annoyance. Green spaces, good shopping facilities, and the quality of public transportation are just some features.
The historic development of a neighbourhood plays an important role concerning annoyance: the change (increase) of the original, characteristic sound level of the neighbourhood makes an increase of the residents' annoyance probable (Höger, 1999; Guski, 1999). However, annoyance increases more than expected from the sound levels. Several studies point in the same direction. They reveal that simply the expectation of the change in the current noise level influences the perceived annoyance, without an actual change in the objective noise level. A study at Sydney Airport shows that the expectation of future noise due to a changed runway configuration increased the reported annoyance (Hatfield, Job, Carter, Peploe, Taylor & Morrell, 2001). After opening a new runway at Vancouver Airport, it was found that residents were significantly higher annoyed than it was expected from the noise levels as such (Fidell, Silvati & Haboly, 2002). Obviously, the non-acoustic factor expectation played a major role. The same effect can be found in the opposite direction: by decreasing the noise level the annoyance decreases below the annoyance of people, who are exposed to these levels already (Griffith & Raw, 1987). The development of noise levels is interwoven with the residents' expectation concerning the future development: residents feel annoyed – independent of the actual development of noise levels – if they expect an increase of noise without having any control or influence on this development (Guski, 1999).

2.5.4.2 Factors of the noise source

Besides the acoustic factors, which are ultimately connected to the noise source (e.g. noise level, tonality; cf. chapter 2.5.2), also the non-acoustic aspects of the noise source are to be discussed. A relation exists between the perceived **size** of the noise source (e.g. car, airplane) and the perceived loudness (Guski, 1987): the bigger it is perceived, the louder it is perceived. The **image** of the noise source is of great importance as well. The image means a socially shared attitude to air traffic per se, to stay in the context of this work. Concerning the image characteristics, especially the features of **dangerousness** and **health threat** are predominant. These have to be separated from individual attitudes, which rather belong to the person-related factors. Against the background of the events of September 11th 2001 as well as the Überlingen midair collision in 2002, the dangerousness has gained importance rapidly and had probably more influence on annoyance than the noise itself for some time.

The assessment of the importance or **necessity** of air traffic moderates the annoyance as well: a person considering air traffic as necessary will be less annoyed – independent of the noise level (Guski, 1999).

2.5.4.3 Situational factors

The **type of activity**, the noise event interrupts, is considered a situational factor (Guski, 1987). Moreover, the extent of **expectation** and the **inappropriateness** of the noise event in the current context are decisive. In case the noise event is unexpected or in case it does not fit the situation (e.g. noise during night), the annoyance will increase (Maschke, 2000).

2.5.4.4 Personal factors

Demographic data (age, gender, socioeconomic status etc.) play only a minor role as noise effect moderating variables (Fields, 1993; Guski, 1987). However, experts consider the fact of house ownership as a relevant factor (Flindell & Stallen, 1999). Men and women do not differ in their response to noise according to Guski (1987), however, Denk (2001) reports about British studies, which have shown that women are more sensitive to noise than men. The importance of potential gender differences increases if the general **noise sensitivity** of a person (an important moderator of noise annoyance) is considered: less noise sensitive people feel less annoyed then sensitive people independent of the noise levels (McKennell, 1963). Job (1999) points out that noise sensitivity cannot be considered as one-dimensional concept and therefore he differentiates between noise sensitivity for loud noises of a far-away noise source and for quiet noises directly near a person. The personal gain (e.g. work at the airport) or compensational measures (e.g. sound insulation) also moderate annoyance (Kastner, 2001).

The stronger the perceived fear or threat due to the noise source gets the stronger the annoyance of a person will be. Within the context of air traffic people might fear harmful exhaust fumes or even plane crashes (chapter 1.1 and 2.2). This variable of fear shows a higher correlation with annoyance than acoustic variables (Schuemer, 1974). Miedema and Vos (1999) consider that the variable of fear plays a major role to explain the variance of noise annoyance.

In contrast to socially shared attitudes (cf. chapter 2.5.4.2) individual attitudes of a person that effect annoyance due to aircraft noise can be differentiated as following:

Attitudes

- towards the *noise* itself (aircraft noise): the extent of annoyance varies with the association a person has (aircraft noise might be associated with freedom or with dangerousness),
- towards the *causer* of the noise (pilot): this means the attitude towards a person that causes the noise (low-level flights might be considered as indication for intentional provocation and therefore as especially annoying),
- towards the *noise source* (airport): the attitude towards the noise source especially in connection with the attributes of dangerousness and health threat (cf. chapter 2.5.4.2) is also important on the personal level. The more the noise source is thought to be dangerous, the more annoying it will be perceived (Höger, 1999). If, contrarily, people are convinced of the necessity of air traffic, they will be less annoyed (Guski, 1999). This is also in line with Lazarus cognitive stress theory (Lazarus & Launier, 1981), in which the cognitive assessment of a stressor (e.g. noise) is seen as precondition for the development of the stress reaction

(Zimbardo, 1995). Lazarus' model will be discussed in chapter 2.5.5.1.

In this context the concept of **"locus of control"** developed by Julian Rotter in the 1960s and – referring to noise research – the concept of **"noise coping"** have to be mentioned. Locus of control refers to an individual perception of the main causes of life events. Generalized expectancies can be differentiated in internal and external control of reinforcement (Bergius, 1998b; Feger, 1998). External locus of control refers to consequences of an action, which lie subjectively beyond the personal control of that person. Having an internal locus of control a person perceives her-/himself as in control over external conditions (outcome of actions are contingent with the own actions) (Zimbardo, 1995). People with an internal locus of control believe that their own actions determine the rewards that they obtain, while those with an external locus of control believe that their own behaviour does not matter much. In case a person realises or perceives that he/she has control and can protect herself from noise, negative effects can be diminished.

A person's ability to deal with noise can be generally described as **coping capacity**, i.e. a person's possibility to cope with noise. The coping strategy can be direct (stop the noise) or indirect (e.g. ignore the noise). The higher the perceived control, meaning the more possibilities a person subjectively has, the less is the perceived stress or the perceived annoyance due to noise (Stallen, 1999). Important aspects that will enhance the perceived control and coping possibilities are the following (TNO-PG/RIVM, 1998):

- **predictability** of the noise situation,
- accessibility of **information** and transparency,
- **trust** in responsible people in charge and consideration of people's interest,
- and the possibility to **participate** as a resident.

The aspects outlined above are the focus of this thesis. Especially, accessibility of information and their transparency are to be investigated. Moreover, the participation of residents will be discussed. Giving access to information (e.g. exact data of the flight path) makes noise events more predictable. In the long run this might also increase the trust in responsible officials. The NoiseCall implementation tried to moderate the perceived control and coping strategies of airport residents by enhancing the aspects listed above. Simultaneously, annoyance due to aircraft noise is expected to decrease.

The predictability of a sound event (i.e. when and in which situation does a certain noise event occur) reduces annoyance in so far, as a person can prepare for it and/or can already plan countermeasures (Guski, 1987). Glass and Singer (1972) consider this predictability as “cognitive control”.

The above mentioned aspects are interwoven: especially the compliance with and implementation of laws and regulations by public authorities play a major role within the context of noise annoyance. The residents’ trust in public authorities affects the perceived annoyance (Matthies, Höger & Guski, 2000). However, an open information policy (Vogt, Haugg & Kastner, 2001; Vogt & Kastner, 2000) and the consideration of public interests constitute a basic precondition for the development of this trust and for the attribution of competency.

Coping strategies and locus of control develop over time. The concept of **learned helplessness** by Seligman (1983) is one example for an unfavourable development, yet has to be taken into consideration as well. Seligman assumes that a person having repeatedly made the experience of no control over external events generalizes this attitude. As a consequence this person feels helpless and withdraws even in uncomfortable situations that might easily be changed (Davison & Neale, 1998). Learned helplessness is typically produced by exposure to uncontrollable events. According to the attributional reformulation (Abramson, Seligman & Teasdale, 1978) the behaviour of helplessness is enhanced by internal, stable, and global attribution. Due to repeated feelings of loosing control a person internalises the inability to change an aversive situation himself/herself (Köper, 2002).

In case of unsuccessful attempts to control noise, learned helplessness and passivity can result for future situations: noise is excepted even though further trials to control noise might be effective (Bell et al., 2001). Bell et al. (2001) describe the most unfavourable situation as combination of high noise level, low predictability of the noise event, and little perceived control. The consequence is high annoyance due to noise. Within the context of noise complaints the concept of learned helplessness has to be kept in mind: it can be the result of the airport's or government's failure to bring about change after complaints have been lodged (Bronzaft et al., 1998). In case satisfying solutions are not found, misfeasance in science, technology, and politics will increase and perceived influence will decrease. Bröer and Wirth (2004) conclude that both developments will result in high annoyance under the same noise load. The authors further ascribe the residents' expectations in political measures a similar importance like the measures themselves. Noise abatement procedures as well as the establishment of trust are tools for an efficient noise policy (Bröer & Wirth, 2004).

2.5.5 Stress concepts

Research on the effects of noise has taken psychological stress concepts into account, which have been briefly mentioned earlier (e.g. Lazarus & Launier, 1981). Depending on the type of concept, stress is understood as harming environmental stimulus (stress as input), as reaction to a stressor (e.g. noise) and therefore as output (Selye, 1976), or as interaction between person and situation (Schwarzer, 2000). First of all, the different terms ought to be differentiated: the psychological glossary (Bergius, 1998a) defines stress as: "organically and mentally any strain, which is experienced as such. … According to Lazarus (1966) stress is not only defined by the situational aspects, but also by their reactions caused by them. Coping strategies, such as escape or repression, are also considered as reactions."

According to the definition of DIN EN ISO 10075 (Zimolong & Stapp, 2001) it is differentiated between mental workload and strain:

- Mental workload… is considered as the sum of all external influences with mental effects.
- Mental strain is a consequence of mental workload that affects a single person depending on his/her preconditions including all individual coping strategies.

Although the definition is rather broad, the negative effects resulting from too high or too low demands are emphasised (Chmiel, 2000). However, ISO mentions individual coping strategies. They were also referred to in chapter 2.5.4 on non-acoustic moderating factors in terms of noise coping strategies. They will be discussed in more detail in the next section (Lazarus' stress model). The interaction of situation and person, which is the core of Lazarus' transactional stress model (1991), characterises the third family of stress concepts after the input (stimulus) and the output (response) models. The Lazarus (1966) model as the earliest and best known representative of the transactional concepts will be discussed in detail.

2.5.5.1 Transactional stress concept

The above mentioned interaction between person and situation is reflected by the term "transaction". Stress and therefore strain does not only arise due to workload, but develops in interaction with a person's subjective assessment (Lazarus, 1991). This mutual influence of situation and person becomes apparent as it is not only the external demand, but also the person's coping behaviour that can change the situation (Köper, 2002). The described interrelations are shown in Figure 6.

Whether a particular demand develops into strain or not, is dependent on the cognitive and subjective assessment of the demand itself (situational appraisal). It also depends on the assessment of the coping strategies (appraisal of resources) (Köper, 2002). The assessment of the situation is considered the "primary appraisal", as subjectively perceived demand, the assessment of the resources is considered as "secondary appraisal". Although the terminology is suggesting a sequence, the secondary appraisal is conceived to take place at the same time as the primary appraisal (Lazarus, 1991).

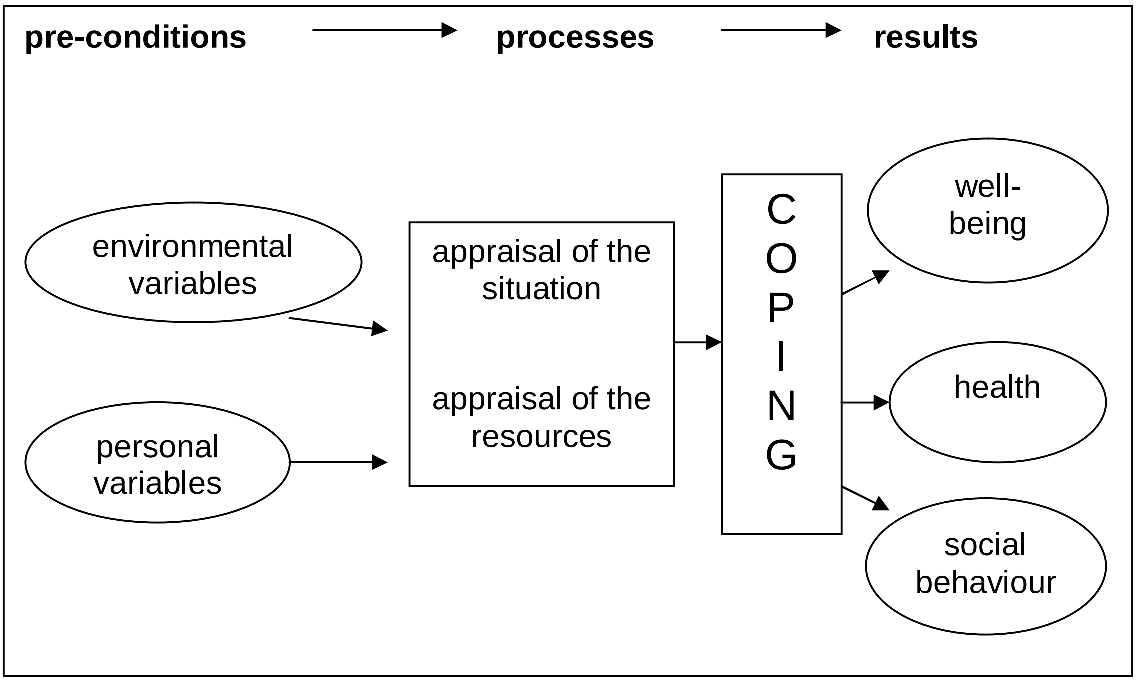

Figure 6: Transactional Stress Model (Lazarus, 1991)

The **primary** appraisal can result in the assessment of the situation as irrelevant, positive, or stressful (Bosshardt, 1988). The appraisal of a situation as stressful can be differentiated in challenge, threat, or harm/loss (Schwarzer, 2000). Once an event has been appraised as stressful – and as worth responding to – coping processes ensue. Whether the situation is perceived as threatening or challenging, is dependent on the **secondary** appraisal, namely the assessment of one's owns coping strategies. Coping can be direct or indirect (Bosshardt, 1988). Direct coping might be the removal or reduction of the threats (e.g. close the windows to avoid noise) and is called instrumental coping (Köper, 2002). Indirect coping can be purely cognitive e.g. by cognitive avoidance (e.g. ignore the noise) or cognitive dissociation from the danger (e.g. tell oneself that although the aircraft is good to hear, the flight path is located one kilometer sideways and a possible crash will not affect the own house). In the course of the assessment of demands and own resources, also a **reappraisal** of the person-situation-relation takes place (Köper, 2002). This reappraisal can follow an actual coping behaviour (problem-focused coping), but can also refer to an intra-psychic dispute. The reappraisal leads to a redefinition of perceived demands (Bosshardt, 1988). The intra-psychic strategy is termed emotion-related or palliative coping, which focuses on alleviating the emotions associated with the stressful situation (Bell et al., 2001).

According to the transactional stress model – transferred to the specific context of noise – one and the same noise event will have different effects depending on the subjective assessment of the demands (noise event, activity currently to perform) and the own resources (coping strategies, cf. chapter 2.5.4.4). Noise effects have to be considered against the background of the specific context of action, because activity interference forms a substantial part of annoyance (chapter 2.5.3.7).

Day's approach (1986) also states different effects of noise depending on the situation: self-produced noise is less annoying than noise produced by others. If the person produces the noise himself, noise is assessed as by-product. In the second case, noise hinders one's own actions and is therefore more annoying (chapter 2.5.3.7).

On the basis of the transactional stress model noise effects are dependent on the assessment of situation and resources and are therefore a consequence of mental processing. After becoming aware of one’s own coping strategies (direct or indirect) the reappraisal can retroact on the appraisal of the situation and therefore modify or even avoid its original effects.

The transactional stress model highlights the meaning and mechanisms of the important factors discussed in chapter 2.5.4, which enhance perceived control and coping possibilities. Within the framework of this thesis the coping strategies of airport residents are to be enlarged and therefore the negative effects of noise ought to be alleviated. It is strived for an improvement of the transparency of the noise situation, the access to information, their transparency, the trust in responsible officials and aviation organisations leaders as well as participation of residents in order to achieve the mentioned goals.

In the next section psychological models of noise effects are presented to give an overview of the interrelations of the manifold aspects within the noise context.

2.5.6 Psychological models of noise effects

Previously, the meaning of the coping strategies has been described as well as the different non-acoustic factors that modify the effect of noise on people. Several psychological theories of noise effects attempt to combine the single aspects into models of causal relationships. In this thesis three conceptual models will be described.

Figure 7 depicts the model developed by Guski (1999). Accordingly, acoustic and non-acoustic factors result in long-term as well as short-term effects. Annoyance as a long-term effect is not directly caused by acoustic factors, but is generated for example by the impairment of sleep.

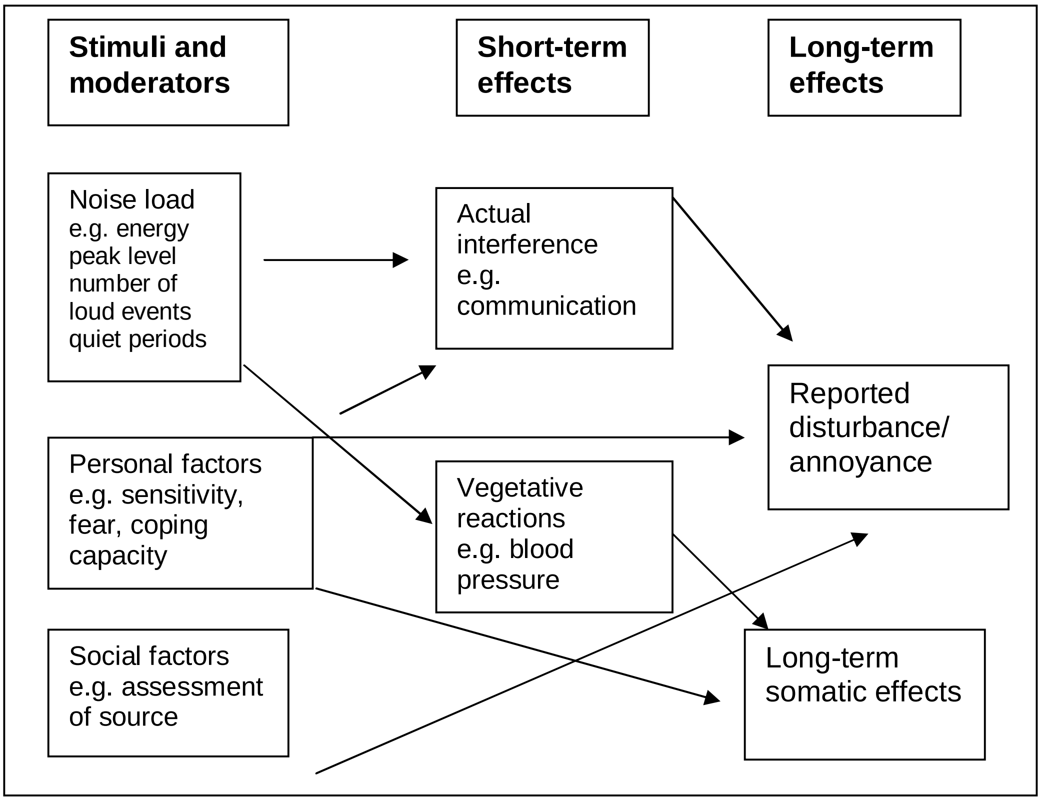

Figure 7: A conceptual model of short-term and long-term reactions to environmental noise. (Adopted from: Guski, 1999).

Guski states that the model considers long-term noise effects as secondary reactions, moderated by short-term reactions and personal and social factors. The described personal and social factors (cf. chapter 2.5.4) have a direct influence on annoyance, but also result in long-term somatic effects. It becomes apparent that noise is not the only reason for annoyance, rather annoyance is defined by non-acoustic factors as well (Höger, 1999). In case the moderators are combined with the sound level, the predictability of the annoyance reaction can be improved.

The model of Fidell et al. (cf. Stallen, 1999) also aims at the description of the interrelation between noise exposure and noise annoyance:

- Noise as external stimulus leads to an internal psychophysical stimulus, which individuals react to differently.
- Exceeding a critical intensity this reaction will result in high annoyance. This threshold value is determined by non-acoustic features. Fidell et al. consider this as *response bias*; yet Fidell et al. do not specify it (Stallen, 1999).
- Differences in the threshold explain differences in annoyance under the same sound exposure.

Stallen (1999) considers Fidell's model as rather psychophysical and regards the psychosocial model of annoyance (Figure 8) as complementary. The psychosocial model adds a psychological explanation for annoyance generation based on psychological stress concepts. The model explicitly integrates external factors other than noise, namely the causer's handling of arising noise (noise management by source). At the same time the model tries to establish a connection between acoustic and non-acoustic moderating factors. The non-acoustic features modify the relation between noise exposure and annoyance.
According to this model noise is not simply generated by perceived disturbance, but the perceived control pathway has a significant impact. Lazarus' stress model (described in chapter 2.5.5.1) constitutes the basis of this concept. The perceived disturbance (cf. the perceived control pathway) corresponds to Lazarus' primary and secondary appraisal. Perceived control is dependent on non-acoustic features, such as the predictability of a noise event or the trust in public authorities. Depending on the quality and quantity of coping resources of a person his/her annoyance will differ even under the same circumstances.
Compared to Guski's concept this model stresses one's own influential possibilities, whereas in Guski's model they are incorporated with personal,

social, and other moderating factors. Both models assume an initial disturbance, which a person perceives. After the person assesses this disturbance negatively, annoyance arises. The psychosocial model (Figure 8) explicitly stresses the meaning of noise management.

Stallen (2000) concludes that "annoyance due to environmental noise is an intrinsic social phenomenon as well as any prevention measure".

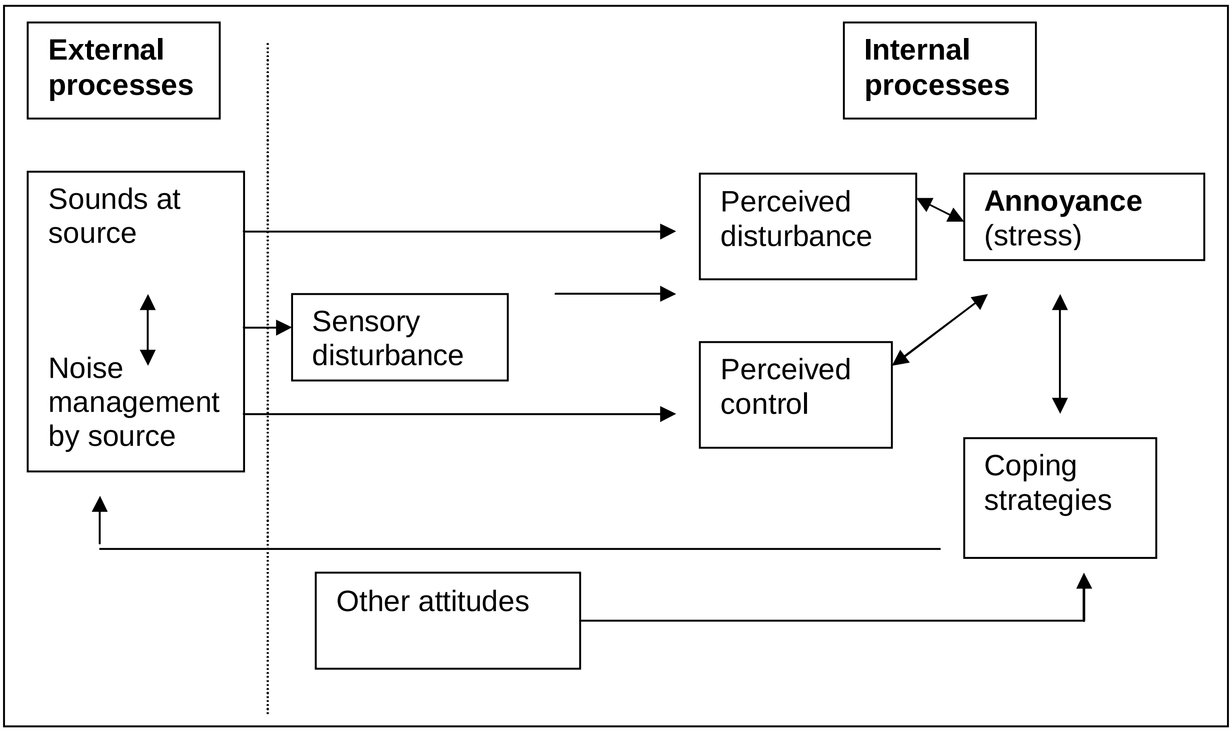

Figure 8: A psychosocial model of annoyance (Stallen, 1999).

The Stallen model depicts a good theoretical framework to prevent annoyance: the personal and social factors are a starting point for prevention as well as intervention measures. The next section on interface design enlarges on this issue.

3 Interface Design

Before the possibilities to design the socio-organisational interface of airport managements and the respective residents are outlined, it will be discussed why an issue such as noise, which can be objectively assessed, is viewed so diversely by the different parties.

3.1.1 Constructivism

As it was outlined in chapter 2.5.6, objective aspects as noise load do not necessarily lead to subjective stress. The feeling of stress and the coping with the perceived stress are also dependent on perception and cognition.
Still, this does not explain the great interindividual differences (see graph of Fidell, Barber & Schultz, 1991; Figure 2). The theory of constructivism can shed some light on these differences.
In the line of constructivism, perception and cognition do not mirror external characteristics, but are a construction of the individual and the individual truth. This includes the participation of the individual in the generation of knowledge, and is therefore called an endogenous perspective. The central point of this theory is the axiom of reality – the way we perceive it – as our very own construction: whether the subjective perception corresponds to the objective, cannot be answered with the construction of reality.

Reality as social construction:
As humans are social beings, the social perspective made its way into constructivism as well. The importance of the social environment has been investigated in terms of coherence with the social group and with the mutual scheme activation: reality is understood as a result of social consensus. In social systems, the members create a common reality and act accordingly. Communication in the view of constructivism is a link between the individual and the social level.

The feeling that others perceive things similar to us, implicates a degree of "reality" to our subjective perceptions. "Real" is what we can agree upon. Therefore, communication is a tool to create reality, because by communicating we find out what others perceive. In the sense of constructivism, communication goes beyond the transfer of information, it is rather a process of construction (to make others do or feel something).

Since – according to the constructivism – reality is subjective with major inter- and intraindividual differences, communication takes an exposed position as a link between social partners.

The radical constructivism is considered radical as it excludes an "objective" reality, and exclusively deals with the organisation of subjective experiences. Watzlawik (1985) claims the following assumptions as central:

Truth and reality are constructed. What we know and perceive, is what we think we perceive. We are not conscious of the construction process. The difference of the radical constructivism and theory of cognition is the relation of knowledge and reality: for the constructivism the relation is determined as functional fit. The existence of an objective reality is irrelevant. The functional fit of our cognitive structures and the world is important to create a world of experience (v. Glaserfeld, 1996). The individual world is generated by the addition of single, coherent experiences. This aspect is important when changing "an individual's world": It needs coherent multiple experiences to change the perception e.g. the perception that an airport management cares about its residents and strives for a good noise management.

Perception is generated in the brain; it is the assignment of meaning to neuronal processes that are originally meaningless (Roth, 1986). The brain is considered the constructor of individual reality and because it is cut off the outer world (only receiving neural or humoral messages) it functions in a so-called self reference (Roth, 1985; Maturana & Varela, 1987). If the reality is merely subjective and everybody lives in and with his own reality, the question arises how we can live in a social system?

Glaserfeld (1985) explains that living systems and their environment match – as long as they exist. The systems are similar organised and structured. That is why reality is constructed in a similar way. The social system and the environment influence each other and exist, as long as they fit. The environment also includes other individuals.

The discussion on the constructivism makes it obvious that we are usually not dealing with the objective reality. Everybody constructs his own reality or view. This is especially true for members of different social systems such as residents and airport management. As already mentioned in chapter 2.3 it is important to consider both sides of the same medal: the same facts are viewed differently by different people, because everyone perceives an interface problem (such as aircraft noise) from their own system's point of view, for example as air traffic provider or as airport resident. Negating and not considering such differences will most probably inhibit any improvement of the relation. Adolph (2003) points out that the relation is influenced by

- social identity and separation tendencies,
- fear of loss of control,
- open and hidden conflicts of interest,
- the perceived history,
- fixed expectations and wishful thinking,
- resistance to innovations, fear of changes,
- the halo effect (judgement mainly influenced by the very prominent characteristics).

All of these aspects are considered non-acoustic variables that determine the relation of noise and annoyance. Adolph adds that partners often do not have the necessary contextual knowledge about the other system or even hold on to prejudices. This also is in line with constructivism: prejudices or simply views on the other system are constructed with coherent experiences. To reduce prejudices, again coherent experiences proving the opposite are required. The open or hidden conflicts often coincide with emotions that hinder reasonable and desirable behaviour. A psychological approach would analyse the co-operational structures and processes as exchange between people (Adolph, 2003). It is necessary to couple the different systems and to create new cognitive schemes for all participants. However, the improvement of co-operation in a psychological way is difficult, as pitfalls have to be considered and interpersonal relations do not function mechanically. Still, it was outlined in chapter 2.5.4 how important the psychological approach is.

3.2 Improvement of the interface

As the judgement of the dangerousness and health impairment of noise correlates with annoyance, it can be reduced by eliminating possibly wrong assumptions. Explaining the real dangers and health risks air traffic possibly has, can help to correct these assumptions. It is important that a trustworthy person gives these information and explanation, as otherwise the residents probably will not accept it. Clarification and information about safety and health facts are a possible way to improve the interface of residents and airport.

Additionally, the attitude of the exposed residents towards the noise, towards the producer of the noise can be improved to reduce annoyance. But the difficulties to change attitudes and also ethical aspects (e.g. manipulation) have to be considered (Guski, 1987).

Another starting point is the locus of control and the coping strategy of a person. Coping behaviour differs inter- and intraindividually: closing a window or associating something positive with the noise are just two examples (Guski, 1987). Simply the thought of being able to do something against the noise can diminish its effects (Vogt, Haugg, & Kastner, 2001; Vogt & Kastner, 2000).

This is in line with Bandura's (1995) concept of self efficacy: "Self-efficacy is defined as people's judgement of their capabilities to organise and execute courses of action required to attain designated types of performances. It is not concerned with the skills someone has, but with the judgements of what someone can do with whatever skills he possesses."

Again, like in Lazarus' stress model, the negative appraisal of the own competencies turns load into stress. Bandura stresses the importance of self-efficacy on behaviour and experience. The concept is based on operant conditioning, which forms an association between behaviour and consequence. Bandura rather focuses on the expectation of the consequence than on the consequence (reinforcement) itself. Bandura differentiates between outcome expectations and efficacy expectations. Efficacy expectations are the individual's convictions to successfully show a particular behaviour or accomplish a goal. Outcome expectations define the theoretical steps necessary for the goal achievement.

Bandura (1986) defines the difference the following way: “Outcome and efficacy expectations are differentiated, because individuals can believe that a particular course of action will produce certain outcomes, but they do not act on that outcome belief because they question, whether they can actually execute the necessary activities.”
The subjective appraisal of one’s own capabilities is important. Referring to the problem of ambient noise, another aspect comes into play (to expect a positive outcome apart from the belief in the own capabilities): the trust in responsible authorities or organisations. In case the authorities are not trustworthy – in the view of residents – the coping seems inefficient. With an open and honest information policy and the consideration of the residents’ interests a base of trust can be established.

Stallen (2000) characterises the view of the residents in relation to the airport as “you expose me”. Considering stress theory and the perceived control a non-acoustic way arises for prevention and reduction of annoyance: the design of a mutual relationship as “you and me”. If conventions are made and followed, the perceived control of residents will increase and trust is built up. Already in the first big noise study in London Heathrow (Committee on the Problem of Noise, 1961) the constructive communication processes were found to reduce noise annoyance. The participation of all partners and the sustainable solution of conflicts (e.g. information exchange) will enhance this constructive dialogue (Chanson, 1989; Vogt & Kastner, 2000). In case of a serious co-operation of noise exposed residents and noise producers a genuine enlargement of coping strategies will result.

According to Lazarus’ transactional stress theory (Lazarus, 1991; Lazarus & Folkman, 1984), stress is a consequence of a person’s inability to effectively cope with demands from the environment. Central to the coping concept is the belief of the person to successfully manage the situation. The feeling of having sufficient coping strategies is based upon the appraisal of the situation and the available competencies and therefore reduces the strain caused by this situation (e.g. noise). Coping strategies comprise direct (e.g. turning off noise source, closing windows) as well as indirect ways (e.g. via cognitive control –

e. g. transparency of the noise situation, who causes the noise and when will it end).

Taking all the concepts together (stress theory, constructivism, self efficacy, models of non-acoustic moderators) the installation of a communication and information tool seems a possible way to tackle noise problems. With the installation of such a tool, the NoiseCall (German “Lärmruf”), in the intervention studies of this thesis, the extension of the residents’ coping possibilities is pursued by facilitating 1. transparency, 2. information, 3. control, and 4. by providing a feedback loop to the airport operator.

As unsuccessful coping might even increase annoyance (Botteldooren, Lercher & Verkeyn, 2003), many precautions were taken to make the NoiseCall reliable (cf. description of the instrument, chapter 4.7). For example a 24-hour service line was installed to make sure to respond to the complainants at the first call. It was mandatory to deal quickly with the complaint. Due to the short feedback loops, both, residents and authorities/airport management, gained from the procedure. The interface of residents and airport management was thus intended to be improved by a moderated communication process via the NoiseCall.

4 Investigation areas and methods

In the next chapters the investigation areas will be described. Kassel-Calden (KAS) and Augsburg (AGB) are the target airports for the NoiseCall studies.

4.1 Description of research areas

4.1.1 Kassel-Calden Airport

Kassel-Calden Airport was founded in 1969. It is located about 8 km northwest of the city of Kassel. The runway (1500 m) is aligned in a northwest-northeast axis (042°/222°[1]). The airport traditionally hosts several helicopter builders, parachuting and flying clubs, and one charter flight a week during summer.
In 1994 there were the first tourist flights; in 1998 Neckermann joined TUI in offering tourist flights from Kassel-Calden. The public was presented a report about the possible airport extension. In 2001, the runway extension to 2500 m was applied for. In 2007/8 the construction is supposed to begin. Air Berlin is interested in Kassel-Calden as a home base. Table 1 depicts the number of movements at Kassel Airport for the year 1999.

Table 1: Number of movements at Kassel Airport in 1999 (from: TÜV Immissionsschutz und Energiesysteme GmbH, 2001)

		Number	
		entire year	6 busiest months of the year
aircraft	≥ 5,7 t	1,217	714
single-engine / multi-engine aircraft	≥ 2,0 to 5,7 t	3,656	2,086
single-engine / multi-engine aircraft	up to 2,0 t	10,409	7,026
helicopter		9,598	4,703
power glider / micro light		8,693	4,964
total		33,573	19,493

[1] The numbers describe the geographical position of the runway in latitude and longitude; for parallel runway systems, „L“ and „R“ are added for „left“ and „right“.

4.1.2 Augsburg Airport

Augsburg Airport was founded in 1928. The Airport is located between Augsburg and Mühlhausen, approximately 6 km northeast of Augsburg city center. The runway is aligned northeast to southwest. The airline Augsburg Airways established its home base there with scheduled flights to Düsseldorf and Frankfurt for example. In 1994, the first connection to a destination outside Germany started (Augsburg-Florence). The airport counted 47,000 movements in the six busiest months of the year 1999. Additionally, Augsburg-Mühlhausen like Kassel-Calden hosts several flying schools and aeroclubs. Therefore, helicopters and sporting planes play an important role, in fact Augsburg-Mühlhausen developed from an aero sport field. The residents had to face airport extensions repeatedly. In 1999, the airport management applied for a new extension due to new joint aviation requirement regulations, which was an alibi argument in the view of the residents. Indeed, the airport management used the extension to also reduce small propeller aircraft for the benefit of ICAO (International Civil Aviation Organisation) 16 propeller airplanes and jets which according to a traffic prognosis for Augsburg-Mühlhausen have a potential to increase by 42% and 580%, respectively, until 2010 (Probst, 2000). In 2000, the number of passengers increased to 972,228 depicting a growth rate of 30% compared to 1999 (Haugg, 2002).

In the early 2000s great mistrust towards the airport has developed. In the view of the residents the information policy proved insufficient and they felt kept in suspense about the planned extensions. In spite of these negative emotions a positive development has to be mentioned: the introduction of a HeliScheduler in order to reduce the helicopter noise (Haugg, 2002).

After the description of airports, the following chapters are dedicated to the investigation methods and procedures that have been applied in the NoiseCall studies. Firstly, the hypotheses are formulated and the research design is presented. Next, the methodology is explained prior to the illustration of data collection process.

4.2 Conjectures

The installation of the NoiseCall was meant to facilitate the communication between airport residents and airport management. The NoiseCall offers an information exchange for both parties on the one hand; on the other hand it provides an opportunity for residents to air their concerns, and for authorities to improve their noise impact management.

The question to be investigated is whether the installation of the NoiseCall leads to a decreased annoyance of the residents. It is assumed that this annoyance reduction is caused by a moderated information exchange between noise producer and perceiver on the one hand and by the residents' opportunity to actively air their annoyance and possibly change the situation on the other hand.

The NoiseCall enhances the residents' noise coping strategies and also gives insights into particular aircraft and arrival/departure procedures respectively. Such information can influence image attributes such as dangerousness of air traffic or possible health impacts as myths can be falsified (e.g. the fuel-dumping myth; Vogt & Nowak, 2003). In the sense of Lazarus' transactional stress theory such information (cognitive reappraisal) can reduce annoyance.

The NoiseCall is also used to remind the airport to stick to low emission arrival/departure procedures and to give feedback about the residents' major concerns respectively.

In order to assess the usefulness of the NoiseCall as an instrument to design the interface between residents and airport authority a survey was conducted before and after its installation.

The theoretical delineations of this study lead to the following conjectures and hypotheses.

It is hypothised that

H1

- the annoyance of the NoiseCall users decreases
- the annoyance of non-users remains constant at a low level

H2

- the contentment with the noise management of the airport improves for users
- the contentment with the noise management of the airport remains at a high level for non-users

H3

- the contentment with the noise management of the local politicians improves for users
- the contentment with the noise management of the local politicians remains at a high level for non-users

Furthermore, it was assessed how annoyance correlates with the non-acoustic parameters such as the contentment with the airport and politicians, with the fear of value loss (of the homes), with the fear of harmful noise effects, and with noise sensitivity (cf. chapter 2.5.4)

4.3 Research design

The study is a 2 (users versus non-users) x 2 (airports) between subject design with repeated measures. The dependent variables of annoyance and contentment with the noise management of the airport/politicians are assessed before and after the installation of the NoiseCall. Table 2 summarises the research design.

Table 2: Research design

airport	group	pre	NoiseCall	post
Augsburg	user	x	used	x
	non-user	x	offered	x
Kassel	user	x	used	x
	non-user	x	offered	x

4.4 Interfering variables

As the studies were conducted in field settings and not in a laboratory, experiment related interfering variables could not be excluded. However, in order to minimise influential aspects during the interview (e.g. distraction) appointments with the residents were made. Moreover, in the selection of investigation areas, it was made sure that the interviewed residents were not affected by other noise sources than aircraft noise.

Person related interfering variables could not be minimised by randomisation. The residents assigned themselves due to their behaviour to the different groups (user / non-user). In order to minimise politically motivated participation, streets where active opponents live were excluded and residential areas with moderate and low noise loads were included as well. However, the self-selection has to be considered in the discussion of the results.

As an alternative to randomisation, the respective variables can be included in the analysis (Klapprott, 1975). Therefore moderating variables (such as noise sensitivity) were assessed as well. Moreover, demographic data, as well as the house ownership, the time of living in the area and other control variables were obtained.

The study was announced by a letter containing information on the general issue of the study. This was applied in order to offer every participant the same level of information without pointing at any specific hypothesis.

The interviewers were thoroughly trained before they were employed, for example with respect to the objectivity of data gathering. The interviews in the different areas were conducted at the same time of the year, so that the noise load did not differ due to seasonal variation (summer/winter flight plan).

4.5 Dependent and independent variables

The usage of the NoiseCall depicts the independent or rather classification variable. Consequently, the group of the users and the non-users are differentiated. The resulting data is analysed using a 2 x 2 analysis of variance with repeated measures.

The annoyance due to aircraft noise, the contentment with the airport's noise management, and the contentment with the local politicians' noise management depict the dependent variables.

The dependent variables are assessed by the means of structured interviews containing open as well as standardised questions. The standardised questions were designed according to Rohrmann (1978) who proved his scale to be normally distributed with equally distant steps. The interviewer read out loud the semantic as well as the numeric 5-point scale.

4.5.1 Operationalisation of dependent variables

The dependent variable annoyance is operationalised by the item:

How annoying do you find the aircraft noise in general?

not at all (1), a little (2), moderately (3), quite (4), very (5) annoying

The variable contentment with the airport's noise management is operationalised by the item:

How content are you with the way the airport deals with the issue of noise?
not at all (1), a little (2), moderately (3), quite (4), very (5) content

The variable contentment with the politicians' noise management is operationalised by the item:

How content are you with the way the local politicians deal with the issue of noise?
not at all (1), a little (2), moderately (3), quite (4), very (5) content

The factors possibly influencing annoyance such as perceived loudness, contentment with health status, fear of heath impairments, fear of value loss etc. are operationalised the same way. A more detailed description of the structured interview can be found in Table 3 or the appendix (p. 143 ff.).

4.6 The NoiseCall

The NoiseCall was a noise line free of charge operated 24 hours a day, 7 days a week. The number 0800-5276783 corresponds to the German word Lärmruf (NoiseCall) on the phone keyboard and can therefore easily be remembered. It was important to offer the NoiseCall 24 hours a day and on weekends as these were the expected times when residents are at home and annoyed by noise and would thus make use of the service. Members of the University of Dortmund, including the author of the thesis, were in charge of the NoiseCall. The responsible University members were all instructed and trained with the interview to maintain a standard service, friendliness, and objectivity. They were as well informed about and instructed on air traffic and airport specific insights. Each call was recorded half-standardised according to the guideline depicted in Table 4.

As far as questions of the residents were concerned (e.g. flight paths) the interviewers fell back on existing documents (flight maps etc.). If desired, further information was gathered from the respective airport authorities and passed on to the resident. The NoiseCall was run for 6 to 8 weeks at each airport.

4.7 Methodology

At all airports, residents (cf. sample selection 4.7.2) were informed via an announcement letter (cf. appendix p. 141) describing the Dortmund University investigation and were asked to participate in the survey. They were asked to indicate certain days and time periods, on which they wished to be contacted (pre-interview). Participants were asked to send their suggestions in an enclosed free return envelope using an answer template. Following the pre-survey, the residents again received a letter informing about the installation and the University's offer of a toll-free NoiseCall together with a sticker containing the number "Lärmruf 0800-5276783" and the Rohrmann answer scale (cf. chapter 4.5). After the installation of the NoiseCall residents received a third letter (enclosing again a free return envelope). They were asked to participate in the evaluation of the NoiseCall (post-interview).

Table 3 shows the pre and post semi-structured interview for all airports and Table 4 outlines the NoiseCall interviews.

Table 3: Structure of the pre- and post-interview (adopted from Vogt, 2002)

Introduction	Background of the study, informed consent, declaration of data protection
Demographics	Gender, age, investigation area, profession
Concern (current situation)	Most intruding noise events (ranking), reasons for interference, loudness of aircraft noise in general (five point rating scale according to Rohrmann, 1978), annoyance of aircraft noise in general (five point Rohrmann rating scale), duration of residence (years), flat/house hired or owned, anxiety of flat/house depreciation (five point Rohrmann scale), private and business use of the respective airport (frequency per year), belief that noise is health threatening (five point Rohrmann scale), contentment with health status (five point Rohrmann scale), sensitivity to noise (five point Rohrmann scale), annoyance of aircraft noise in general (seven point rating scale according to VDI 3883)
Heading for good neighbourhood (desired situation)	Description of the relationship residents-airport, emotion, contentment with the noise management of the airport/ politicians, ranking of people having financial benefits through the airport, vision of good neighbourhood, what could the airport do to reach and sustain good neighbourhood, what could the residents do, probability of improvement by scientific mediators (five point Rohrmann scale), probability of using the NoiseCall (five point Rohrmann scale), positive influence of annoyance abatement procedures like NoiseCall on attitude towards airport (five point Rohrmann scale), conditions for coming round to a sustainable extension of the airport, participation in further studies
Additional items post-interview	Airport specific questions such as: Knowledge about the limitation of helicopter flights, to what extent was this noticeable (five point Rohrmann scale), why/why not was the HeliScheduler effective, further desires with respect to helicopter operations, probability of thereby achieved good neighbourhood (five point Rohrmann scale); which extension plan do you prefer; how strongly do you approve the extension (five point Rohrmann scale)

Table 4: Structure of the NoiseCall interview (according to Vogt, 2002)

Case characteristics	Gender, age, investigation area Code, date, time of day
Complaint	Reason for the call, date and time of the noise event, description of the aeroplane, flight routes and heights, activity being disturbed, extent of interference and annoyance (five point rating scale)
Potential countermeasures	What could the airport do to tackle the specific problem which triggered the call, probability that thereby the attitude of the caller towards the airport would change (five point rating scale), usefulness of the NoiseCall (five point rating scale), if medium or less useful what can be improved, two further questions on specific noise problems of the respective airport
Ring back	Time, date, and telephone number for a ring back if necessary and/or desired, satisfaction with ring back (five point rating scale), if medium or less satisfied what else was desired

After the treatment period the post-interviews were conducted (cf. Table 3). As for the pre-interviews, the residents received an announcing letter. Again they had the possibility to propose a certain day and time for the interview (free return envelope). The post-interview was almost identical to the pre-interview, some airport specific questions (e.g. about extension possibilities in Kassel-Calden) were added.

4.7.1 Socio-demographic data

The socio-demographic data obtained with the questionnaire relate to the respondents' gender, age, current professional status, and investigation area (cf. Table 3 and appendix p. 143 ff.).

4.7.2 Procedure

At first, the selection of the sample will be described followed by the description of the collection procedure.
The selection of the different residential areas (low and high noise load) was made accordingly to the respective noise report (e.g. for Kassel-Calden written by TÜV Immissionsschutz und Energiesysteme GmbH, 2001). These reports describe the calculated noise load for different areas around the airports. After the selection of the areas they were further narrowed down to streets, which were isolated from other noise sources (like railway, highways etc.). Using the electronic phone book, residents living in the selected streets were added to an address file for each investigation. One person of each household was selected.

After the sample selection the announcement letter for the study was sent (appendix p. 141) asking the subjects to participate. For the pre-interview, the volunteers were called first. As the response rate was low (e.g. in Kassel-Calden only 7.3% responded), other residents, who had also received the announcement letter, were called. At all times, participants were informed that anonymity is ensured.
The pre-interviews began with information on the study, the University's independency, and the financial background of the study. After recording the socio-demographics the semi-structured interview was conducted (cf. Table 3). The interviews lasted between 15 and 45 minutes. The length of the interview depended on the resident's answering behaviour.
The NoiseCall itself usually did not take longer than 10 minutes, however in some cases, more elaborated questions were asked. First, the resident's code, the date and time of day were recorded as well as the socio-demographics (Table 4). The recording of the reason for the call, date and time of the noise event and extent of interference and annoyance followed. In case further investigations were needed to answer the resident's questions and concerns, a time of day was agreed upon for a ring back.
For the post-interview all participants of the pre-interview received the announcing letter. Of the 343 pre-interviewed residents 129 gave a second interview.

4.7.3 Methods of statistical analysis

The data is subjected to a 2 (user/non-user) x 2 (pre/post-interview) x 2 (airports) analysis of variances (ANOVA) for testing the effect of the NoiseCall usage on annoyance and the contentment with the airport's/politicians' noise management. The main used statistics are F- and t-tests as well as correlation and regression analyses.
The sample characteristics are presented in descriptive frequency tables; demographic variables were tested by chi-square tests in order to assess the comparability of the groups.
For all procedures the formal assumptions of normal distribution, homogeneity of variances, and independency are made (Bortz, 1999).
Deviations from these preconditions are being considered in the selection of analysis tools and in the interpretation of the data.

Correlation and regession analyses are calculated to identify defining aspects of annoyance, especially to find evidence for the importance of non-acoustical factors. Therefore, annoyance is correlated with the perceived loudness, with the fear of health impairments, the fear of a loss in property value, and others. The correlation coefficients are tested for significant deviation from 0. The regession analysis tried to predict perceived annoyance with the mentioned variables (cf. chapter 5.5).

With multiple testing, the probability values were alpha-adjusted according to Holm (Holm, 1979; Krauth, 1988). Equally, as the non-acoustic factors are not independent, the t-tests for the correlation coefficients were alpha-adjusted according to Holm as well. The procedure is based on the following steps. The probability values are put into order by size. The smallest probability value is compared to α/r; r depicts the number of conducted tests. The test is significant, if the probability value is smaller then the α-adjusted value. The procedure is continued with the second smallest probability value compared to α / r-1. The procedure is stopped if one of the probability values is larger then α / r-x. This particular test as well as the following tests is considered as not significant.

The analyses were conducted with the statistical package for social sciences (SPSS, version 13.0).

4.7.3.1 Data processing

Answering the standardised questions single participants could not stick to the 5-point scale, but located themselves between two labels. These cases were accepted in order to loose neither information nor acceptance. The data entry was done as the mean of the two scale levels with one decimal place. Missing data had to be accepted as well. Due to this procedure the data analyses are based on different sample sizes and have lead to a variation in the degrees of freedom.

The sample sizes of the two subgroups (users and non-users) vary considerably. As only very few residents made use of the NoiseCall the pool for a post-interview in this sample was small. However, with great effort, a post-interview could be conducted with every user. Still, considerable more post-interviews were obtained from non-users. Even though the data analysis procedures are quite robust to deviations from the assumptions (Bortz, 1999; Diehl, 1979; O'Brian & Kaiser, 1985), the author decided to gain equal sizes for each cell by matching a non-user to each user. O'Brian and Kaiser (1985) point out that the analysis of variance is robust against deviations from equal variances with equal cell sizes.
For the respective analyses this procedure has lead to relatively small sample sizes, but also to a smaller risk of violating necessary assumptions. The matching procedure followed the criteria of 1. airport, 2. gender, 3. age, 4. noise load.

4.7.4 Sample characteristics

In total (cf. Table 5), 343 residents have been interviewed, 129 of them twice, resulting in 472 conducted interviews.

Table 5: Participants of the pre- and post-interview

	pre-interview	post-interview	Total
Augsburg	172	53	225
Kassel	171	76	247
Total	343	129	472

Table 6 shows the distribution of gender in the pre- and post-study: 175 female and 164 male subjects (4 missing genders) participated in the pre-interview. The women depict 52% of the pre-sample: Gender is therefore equally distributed ($chi^2_{(1)}$ =0.36; p=.550). In the post-interview 69 female and 51 male subjects (9 missing) participated. Here, women depict 57.5% of the post-sample: Gender is equally distributed in the post-sample as well ($chi^2_{(1)}$ =2.70; p=.100).

Table 6: The distribution of gender

	Female		Male	
	pre	post	pre	post
Augsburg	93	27	79	18
Kassel	82	42	85	33
Total	175	69	164	51

The mean age of the total sample is 46.4 years (SD=14.5). With an average age of 48.6 (SD=15.2) the male subjects were slightly, but significantly ($t_{(344)}$=2.59; p=.010) older than the female participants (M=44.5; SD=13.7).

The age also differs between the groups of airport residents ($t_{(346)} = -2.61$; $p=.009$): participants from Augsburg are younger (M=44.5; SD=14.4) then those from Kassel (M=48.5; SD=14.4).

Almost one fifth of the participants are retired (17.3%). The second largest group are the housewives (16.7%), followed by participants working in the trading business (15.8%). The other professions range from 4% to 10% of the sample.

5 Results

5.1 Control variables

The variable house ownership is not equally distributed in the sample (Table 7). Significantly more participants own a house instead of renting a house or flat ($chi^2_{(1)}$ = 141.57; p<.01). Among the 345 residents who answered the question of house property, 82% lived in their own houses or flats. The two airport-samples do not differ in the distribution of house ownership ($chi^2_{(1)}$=0.02; p=.877).

Table 7: Frequency of house ownership

	Rent	Owner	Total
Augsburg	32	143	175
Kassel	30	140	170
Total	62	283	345

On average, the participants have lived for 18 years (SD=16.12) in their homes (AGB: M=16.9; SD=15.4 / KAS: M=19.5; SD=16.8). The occupancy does not differ between the Augsburg and Kassel sub-samples ($t_{(348)}$=-1.51; p=.133).

The fear of a loss in the value of the homes is slightly stronger in Augsburg (M=3.3, SD=1.5) and less distinct in Kassel (M=2.5; SD=1.5). The total sample fears a value loss little to moderately (M=2.9; SD=1.5). The difference between the Augsburg and Kassel sample is significant ($t_{(266)}$=4.36; p=.000).

The total sample rates the own noise sensitivity with 3.0 on a 5-point scale, indicating a moderate noise sensitivity (Table 8). The two sub-samples do not differ significantly in their subjective noise sensitivity ($t_{(340)}$=-1.07; p=.280). The belief that noise affects health is quite strong with 3.8 (quite impairing) for the total sample. Again the sub-samples do not differ significantly ($t_{(337)}$=0.37;

p=.720). The sample is quite (M=4.0) content with the own health status. However, the participants from Kassel are significantly more content (4.1) then the participants from Augsburg (3.9) ($t_{(339)}$=-2.16; p=.030).

Table 8: Noise sensitivity, health impairment, and health status

	Noise sensitivity		Noise as health impairment		Contentment with own health status	
	M	SD	M	SD	M	SD
Augsburg	2.90	1.18	3.85	1.23	3.85	1.16
Kassel	3.04	1.23	3.81	1.15	4.11	1.05
Total	2.97	1.21	3.83	1.19	3.98	1.11

On average, all participants fly about two times per year (1.8). However, some residents fly quite frequently (SD=5.9). The sub-samples do not differ significantly in the flying frequency ($t_{(308)}$=0.87; p=.390). [Augsburg: M=2.1; SD=6.5; Kassel: M=1.5; SD=5.4].

The total perceived loudness of the aircraft noise (cf. Table 9) is moderate (2.8 on a 5-point scale; SD=1.2). However, it differs significantly at the two airports ($t_{(339)}$=5.02; p=.000): Augsburg residents (M=3.1; SD=1.2) perceive the aircraft sounds as louder than the residents in Kassel (M=2.51; SD=1.1).

Table 9: Perceived loudness

	N	M	SD
Augsburg	172	3.13	1.16
Kassel	169	2.51	1.12
Total	341	2.82	1.18

In order not to violate the assumptions of the analysis of variances (cf. chapter 4.7.3), the group of users has been matched to a non-user group according to the airport, their gender, their age, and the noise load in the respective residential area. The matching process ensures that the two groups (users and non-users) neither differ in the distribution of gender nor age nor noise load. The matching process, however, leads to a reduction of the non-user sample size (users in Augsburg: N=7; users in Kassel: N=9; resulting in 16 users matched to 16 non-users).

More women (9) then men (7) used the noise call. This difference is not significant ($chi^2_{(1)}$=0.25; p=.620). Only three of the 16 users did not own a house. The difference is significant as in the total sample ($chi^2_{(1)}$=6.25; p=.010).

5.2 Annoyance

The following analyses of variance are calculated with matched samples as described above. As discussed, this procedure has been applied in order not to violate the assumptions of the analysis of variances.

Considering the entire sample, with users from both airports, the annoyance stayed constant at a moderate to high level (3.2 to 3.3 on the 5-point scale) against H1. As expected, the annoyance of non-users stayed constant at a low to moderate level (2.6 to 2.9 on a 5-point scale). The same analyses within each airport revealed that at Augsburg airport, the annoyance increased for both groups (users from 2.9 to 3.9; non-users from 2.7 to 3.1).
Only the Kassel data supported H1 entirely: non-users annoyance stayed at a low to moderate level (2.6 **à** 2.7) and users were less annoyed in the post-interview 2.9 relative to 3.4 in the pre-interview.

Table 10: Means M and standard deviations SD of annoyance before and after the NoiseCall

		pre		post	
		M	(SD; N)	M	(SD; N)
Total	user	3.22	(1.38; 16)	3.34	(1.19; 16)
	non-user	2.63	(1.31; 16)	2.88	(1.44; 16)
Augsburg	user	2.93	(1.10; 7)	3.93	(1.17; 7)
	non-user	2.71	(1.38; 7)	3.14	(1.46; 7)
Kassel	user	3.44	(1.59; 9)	2.89	(1.05; 9)
	non-user	2.56	(1.33; 9)	2.67	(1.48; 9)

A univariate analysis of variance with repeated measures was conducted with the following factors: repeated measure (pre- versus post-interview), usage of the NoiseCall (users versus non-users), and airport (Augsburg versus Kassel).
As test statistic Pillai's trace is used, as it is considered as the strongest and most robust test (Bühl & Zöfel, 2002).

Table 11: Analysis of variance – annoyance

Main effect of time (repeated measure)	$F_{(1, 28)} = 0.88$	$p = .357$
Main effect of usage	$F_{(1)} = 1.75$	$p = .196$
Main effect of airport	$F_{(1)} = 0.53$	$p = .474$
Interaction usage x airport	$F_{(1)} = 0.01$	$p = .945$
Interaction time x usage	$F_{(1, 28)} = 0.01$	$p = .928$
Interaction time x airport	$F_{(1, 28)} = 3.18$	$p = .085$
Interaction time x usage x airport	$F_{(1, 28)} = 1.39$	$p = .248$

$F_{(e,f)}$: F-value
e/f: degrees of freedom
p: probability value

Table 11 shows the results of the analysis of variance for the annoyance ratings. No main effect of time (repeated measure) is detected ($F_{(1, 28)}$ =0.88; p=.357). Obviously, the NoiseCall per se (independent of usage) does not reduce annoyance over time.

Users are not significantly more annoyed than non-users ($F_{(1)}$=1.75; p=.196). There is neither a significant difference between airports ($F_{(1)}$=0.53; p=.474), nor is there a significant interaction of usage and airport ($F_{(1)}$=0.01; p=.945).

As annoyance reduction is assumed for the residents, who actually used the NoiseCall, the interaction of time and usage is interesting. However, this interaction also reveals no significance ($F_{(1, 28)}$=0.01; p=.928).

No significant interaction exists between the repeated measure (time) and airport, though it is close to being significant ($F_{(1, 28)}$=3.18; p=.085). This interaction indicates a difference between the airports at different points of time. The triple interaction of time, usage, and airport again is not significant ($F_{(1, 28)}$=1.39; p=.248).

With reference to the descriptive data (cf. Table 10) of annoyance over time the following argumentation is pursued: In Augsburg annoyance data of both user and non-user groups increased over time, which contradicts the proposed assumptions, and will be discussed later. In Kassel, however, the annoyance of users decreased over time, which is in line with the hypothesis. Kassel users were on average moderately to quite annoyed (M=3.4; SD=1.6) at the time of the pre-interview. The annoyance decreased to a moderate level after the NoiseCall was installed (M=2.9; SD=1.1). Since the analysis of variance is a very conservative test, a t-test was conducted additionally for the Kassel sub-sample. As it is hypothesised that annoyance reduces after using the NoiseCall, the t-test is conducted one-tailed. The decreased annoyance of Kassel users is statistically significant ($t_{(8)}$= 1.89; p=.048).

In summary:

The main effect of time (repeated measure) on annoyance as well as the interaction of time and usage, time and airport, and the triple interaction of time, usage, and airport are not significant. The hypothesis that the annoyance of users decreases over time needs to be rejected. However, to pay tribute to the descriptive data and to the fact that the analysis of variance is a conservative testing method, the Kassel sub-sample has been further analysed: A significant reduction of annoyance was detected for the Kassel users.
As assumed, the annoyance of non-users remains constant over time.

5.2.1 Annoyance and Contmentment

Interestingly, as outlined in the chapter above, a significant annoyance reduction was detected for Kassel only. The different starting situations in Kassel and Augsburg as far as the relation between airport and residents is concerned (which will be further discussed in section 6) might influence the effectiveness of the NoiseCall tool.
In order to find statistic evidence for this assumpution, the procedure is as following: A variable is calculated by subtraction of the pre- and the post-annoyance resulting in a variable of annoyance change. A univariate analysis of variance is conducted with the group factor airport and the dependent variable annoyance change. In a second univariate analysis of variance the contentment with the airport's noise management (pre) is included as a covariate.

The univariate analysis of variance does not reveal a significant difference between Augsburg and Kassel residents in their annoyance change. However, the main effect is close to being significant ($F_{(1,32)}$=3.24; p=.08). Including the contentment with the airport's noise management, the analysis of variance shows a non-siginifanct main effect: $F_{(1,27)}$=1.28; p=.27.

In summary:

A very careful plausibility conclusion can be derived from the described results. The main effect of the airport (Kassel vs. Augsburg) concerning the change in annoyance might be traced back to differences in the attribute contentment with the airport's noise management (before the installation of the NoiseCall). This can be derived from the diminished main effect when considering the contentment as a covariate. However, this is only a careful conclusion.

5.3 *Contentment with airport's noise management*

Table 12 shows that generally the contentment with the airport's noise management increased or remained constant after the NoiseCall had been installed. The only exception is the group of Augsburg's non-users, who reported decreased satisfaction with the airport's noise management. For Kassel an increase in contentment with the noise management can be detected for both users and non-users.

Table 12: Means M and standard deviations SD of the contentment with the airport's noise management before and after the NoiseCall

		pre		post	
		M	(SD; N)	M	(SD; N)
Total	user	1.69	(1.11; 13)	2.08	(1.38; 13)
	non-user	2.27	(1.58; 15)	2.53	(1.69; 15)
Augsburg	user	1.50	(0.55; 6)	1.67	(1.03; 6)
	non-user	2.57	(1.99; 7)	2.29	(1.70; 7)
Kassel	user	1.86	(1.46; 7)	2.43	(1.62; 7)
	non-user	2.00	(1.20; 8)	2.75	(1.75; 8)

A univariate analysis of variance with repeated measures was conducted with the following factors: repeated measure (pre- versus post-interview), usage of the NoiseCall (users versus non-users), and airport (Augsburg versus Kassel). The results are shown in Table 13.

Table 13: Analysis of variance – contentment with airport's noise management

Main effect time (repeated measure)	$F_{(1, 24)} = 1.17$	$p = .291$
Main effect of usage	$F_{(1)} = 1.17$	$p = .290$
Main effect of airport	$F_{(1)} = 0.26$	$p = .616$
Interaction usage x airport	$F_{(1)} = 0.38$	$p = .544$
Interaction time x usage	$F_{(1, 24)} = 0.06$	$p = .808$
Interaction time x airport	$F_{(1, 24)} = 1.68$	$p = .208$
Interaction time x usage x airport	$F_{(1, 24)} = 0.32$	$p = .576$

$F_{(e,f)}$: F-value
e/f: degrees of freedom
p: probability value

A significant increase in the residents' contentment with the airport management has not been detected. The analysis reveals no significant differences between the users and non-users or between the two airports. Users and non-users do not differ in their contentment; neither do residents at the different airports. Neither has an interaction effect between usage and airport been detected.
The interactions of time and usage or time and airport and the triple interaction of time, usage and airport are not significant.

The Kassel data are further analysed due to similar reasons as described above. The descriptive data reveal an increase in contentment for users and non-users. This was hypothesised for the user group. For the non-users the contentment was assumed to stay constant over time. Therefore, both groups are further analysed. Due to the multiple testing, the probability values are adjusted according to Holm (cf. 4.7.3). The tests are conducted one-tailed for users and two-tailed for non-users as this hypothesis has not been specified (cf. chapter 4.2).

The increase of contentment for both users ($t_{(6)}$= -1.55; p=.086; Holm p= .050) and non-users ($t_{(7)}$= -1.82; p=.056; Holm p=.025) is not significant. However, the increase of contentment for users comes close to significance and is therefore heading in the assumed direction. For non-users it was hypothesised that the contentment would remain constant.

In summary:

The main effect of time on contentment with the airport's noise management is not significant. Neither is the interaction of time and usage as assumed. The interactions of time and airport and time, airport, and usage are also not significant.

The tendencies the descriptive statistics reveal cannot be verified statistically. However, the decrease of contentment within Augsburg's non-users and the increased contentment of Kassel users and non-users needs to be discussed.

5.4 Contentment with politicians' noise management

All in all the contentment with the way local politicians deal with the issue of noise at both airports is quite low for users (1.6 **à** 1.9) and non-users (2.3 **à** 2.1) and does not considerably change over time (cf. Table 14). Taking a look at the airports separately, Table 14 reveals that the contentment of Augsburg users as well as non-users even decreased slightly. Only for Kassel users, an increase can be detected (1.5 **à** 2.3). Interestingly, all participants are only little satisfied with the politicians' noise management.

Table 14: Means M and standard deviations SD of contentment with politicians' noise management

		pre		post	
		M	(SD; N)	M	(SD; N)
Total	user	1.55	(0.82; 11)	1.91	(1.30; 11)
	non-user	2.27	(1.28; 15)	2.07	(1.16; 15)
Augsburg	user	1.60	(0.89; 5)	1.40	(0.89; 5)
	non-user	2.71	(1.38; 7)	2.43	(1.40; 7)
Kassel	user	1.50	(0.84; 6)	2.33	(1.51; 6)
	non-user	1.88	(1.13; 8)	1.75	(0.89; 8)

The results of the univariate analysis of variance are shown in Table 15. No significant main effect of time on the contentment with the politicians' noise management can be detected. All in all, the contentment with the noise management has not changed significantly over time.

The two groups of users and non-users do not differ in their contentment with the politicians' noise management. The effect of the airport and the interaction of usage and airport are not significant.

Neither the interaction of time and usage, time and airport, nor the triple interaction of time, usage, and airport indicates a significant difference.

Table 15: Analysis of variance – contentment with politicians' noise management

Main effect time (repeated measure)	$F_{(1, 22)} = 0.04$	p = .845
Main effect of usage	$F_{(1)} = 1.76$	p = .198
Main effect of airport	$F_{(1)} = 0.22$	p = .643
Interaction usage x airport	$F_{(1)} = 2.61$	p = .121
Interaction time x usage	$F_{(1, 22)} = 0.86$	p = .364
Interaction time x airport	$F_{(1, 22)} = 1.13$	p = .300
Interaction time x usage x airport	$F_{(1, 22)} = 0.60$	p = .446

$F_{(e,f)}$: F-value
e/f: degrees of freedom
p: probability value

As in the section above, the Kassel data are further analysed, because the descriptive data reveal for users an increase in contentment. The test is being conducted one-tailed.
The increase of contentment for users ($t_{(5)}$= -1.11; p=.159) is not significant.

In summary:

A significant main effect of time on the contentment with the politicians' noise management has not been detected. Neither were the interactions of time and usage, time and airport, or time, usage, and airport.
Looking at the descriptive statistics, the contentment with the politicians' noise management increased for Kassel users, however, not significantly.

5.5 Correlation and Regression analyses

In order to detect the influence of non-acoustic variables on annoyance in the sense of the psychological models of noise effects (cf. chapter 2.5.6), correlations have been analysed at first.

Table 16 depicts the correlations, which have been put into order by size. According to Bühl and Zöfel (2002) the following verbal description of the correlation coefficient are common: up to 0.2 – very low correlation, 0.2 to 0.5 – low correlation, 0.5 to 0.7 – medium correlation, 0.7 to 0.9 – high correlation, over 0.9 – very high correlation.

The significance values have been adjusted according to Holm (cf. 4.7.3).

The perceived loudness correlates with perceived annoyance to .72 and can therefore be considered a high correlation.

The fear of a loss in the value of the homes correlated to .60 with annoyance: the more the residents fear a value loss, the more they are annoyed. The third largest correlation (-.52) exists between annoyance and the contentment with the noise management of the airport: the more the residents are content with the noise management, the less they are annoyed. Both correlations are of medium size.

The correlation of annoyance with the contentment of the politicians' noise management is also negative, but smaller in size (-.38). The correlation with the fear of health impairments due to noise ranks in the same size, yet, as expected in a positive direction (.36). Interestingly, the correlation with the calculated actual noise load is only low with .28. This supports the evidence described in chapter 2 and 3 that acoustic factors do not play the most important role in annoyance generation.

The contentment with one's own health status and noise sensitivity barely correlate with noise annoyance. The correlation with the time living in the respective area (occupancy) is not significant.

Table 16: Correlations with perceived annoyance

variable	correlation	p	p(Holm)	sig.	n
Perceived loudness	.69**	.000	.0011	h.s.	339
Loss of value (homes)	.60**	.000	.0013	h.s.	266
Contentment with noise management (airport)	-.55**	.000	.0014	h.s.	269
Contentment with noise management (politicians)	-.39**	.000	.0017	h.s.	270
Health impairments due to noise	.33**	.000	.0020	h.s.	338
Noise load (Leq)	.28**	.000	.0025	h.s.	237
Contentment with own health status	-.23**	.000	.0033	h.s.	339
Noise sensitivity	.10*	.032	.0050	s.	340
Occupancy	.06	.149	.0100	n.s.	340

Significant correlations are marked: ** p <.01; * p<.05; p=probability; p(Holm)= probability value adjusted according to Holm; sig.=significance; n=sample size; h.s.=highly significant; s. = significant; n.s.=not significant

A regression analysis is conducted to evaluate the above mentioned variables as predictors for the perceived annoyance (for the correlation matrix of the nine variables see appendix p. 167). The nine variables accout for 62% of the variance (R^2=.62)[2], which is considered a large effect. The regression model is significant ($F_{(9,130)}$=23.68; p=.000). Table 17 reveals the results. The variables are put into order by the size of the respective beta-coefficient. The variable perceived loudness has the largest beta-coefficient (β= .47). The second most relevant predictor is the variable contentment with the politicians (β= -.24). The variable of value loss has the third largest beta-coefficient, which is only close to significance (p=.095). The variable occupancy is a significant predictor with smaller sized beta-coefficient (β= .12). Interstingly, the acoustic variable noise load does not emerge as a significant predictor.

[2] R squared is the proportion of variation in the dependent variable explained by the regression model. The interpretation of the effect is based on the operational categories of small ($R^2 \geq .02$), medium ($R^2 \geq .13$) and large ($R^2 \geq .26$) effects (Cohen, 1988).

Table 17: Results of the regression analysis predicting perceived annoyance with 9 variables

variable: perceived annoyance	β	p
Perceived loudness	.47	.000
Contentment with noise management (politicians)	-.24	.008
Loss of value (homes)	.14	.095
Occupancy	.12	.036
Contentment with noise management (airport)	-.08	.406
Health impairments due to noise	.08	.237
Noise load (Leq)	-.07	.305
Noise sensitivity	-.06	.290
Contentment with own health status	-.04	.533

β: standardised coefficient

In order to enlarge on the results, another regression analysis is conducted considering the four variables with the largest beta-coefficients (cf. Table 17). The results are shown in Table 18. The regression model is significant ($F_{(4,214)}$=71.45; p=.000).

Table 18: Results of the regression analysis predicting perceived annoyance with 4 variables

variable: perceived annoyance	β	p
Perceived loudness	.52	.000
Loss of value (homes)	.23	.000
Contentment with noise management (politicians)	-.16	.003
Occupancy	.05	.264

β: standardised coefficient

The four variables account for 57% of the variance (R^2=.57), which is a large effect. Again, the perceived loudness is the most relevant predictor variable for perceived annoyance with a beta-coefficient of .52.

In summary:

Looking at the correlation analysis, the impact of the non-acoustic factors of the fear of a value loss and the contentment with the airport's noise management are very prominent. The connection with the noise load, however, is remarkably low.

The belief in health impairments due to noise and the contentment with the politicians' noise management also impact noise annoyance, whereas one's own reported noise sensitivity plays a minor role. Apparently, it does not make a difference for the perceived annoyance how long the residents have been living in the respective area. The own flying behaviour does not reduce the amount of annoyance. All in all, the found correlations are in line with the described psychological models of annoyance: the data at hand stress the importance of non-acoustic variables.

This result is supported by the regression analyses. The nine acoustic and non-acoustic variables explain 62% of the variance in the dependent variable. Considering only the most prominent predictors, they still account for 57% of the variance. Again, the noise load plays a minor role. The variables perceived loudness, fear of a value loss, contentment with the politicians, and the time living in the area of of major importance for the perceived annoyance.

6 Discussion

Firstly, the sample composition is to be discussed. The high participation of retired residents and housewives can be traced back to the fact that probably both groups are more present at home having more time to use the NoiseCall than residents who leave their homes for work. Still, this leaves the question why others did not participate that much even though they might be affected especially during the evenings and on weekends. It might be due to personality differences, which are dealt with in chapter 7.

The high percentage of residents owning a house can be explained by the fact that especially in rural areas – like those investigated in this thesis – the percentage of residents owning a house rises up to 80% (Noll, 1998). This corresponds to the percentage found in the present sample. Therefore, the difference in the sample is just representative for rural areas.

The fear of a property value loss differs between the two sub-samples: it is higher in Augsburg. This is probably due to the higher exposure levels which are also reflected in higher perceived loudness values for the Augsburg sample. Additionally, Augsburg Airport was the busiest NoiseCall airport at the time of the data collection.

In regards to noise sensitivity, the two sub-sample both held the same views on the belief of noise impairing health, and the contentment with the own health status. The total sample is characterised by a moderate noise sensitivity, a strong belief in the impairing effects of noise on health, and satisfaction with the own health status. Male and female participants alike made use of the NoiseCall.

The NoiseCall does not affect perceived annoyance to the assumed extent. Annoyance after the installation of the NoiseCall has not decreased significantly in general. Interestingly, only in the group of Kassel users a significant annoyance reduction was observed. Opposingly, in Augsburg the descriptive data reflect that annoyance even increased.

For the dependent variable of contentment with the airports' noise management a slight general increase for users is detected as expected. However, this increase is not significant. In Augsburg the contentment of the non-users even decreased slightly, for the users it increased. In Kassel, an increase for both groups was detected, yet again below statistical significance.

As far as the contentment with the politicians' noise management is concerned no significant changes are identified. Looking at the descriptive data, a small overall increase for users is found. In Augsburg the contentment of both users and non-users decreased. In Kassel, again the contentment of the users increased over time, which is at least in line with the hypothesis, however, below statistical significance.

To judge the Augsburg data, the following has to be kept in mind: the relationship between Augsburg residents and the management is characterised by deep mistrust as the airport has been extended in a so called "salami tactic". Residents have felt to be kept in suspense. Further mistrust is spread due to the noise load and the related health impairments the residents ascribe to the noise. Furthermore, the residents stated on numerous occasions that they fear that airplanes dump fuel. Again, a lack of information is apparent as only in the very rare case of an emergency landing fuel has to be dumped for safety reasons.

In such a situation, where the trust is already spoiled, a tool like the NoiseCall falls upon stony ground. In contrast, Kassel users are significantly less annoyed after using the NoiseCall and more content with the local noise management. In Kassel, a different approach was used in proceeding with the airport extension. The project management works cooperatively with local authorities and community representatives. With great effort, different lengths and positions of the runway were simulated with respect to noise contours. In one case, the number of people exposed to a daytime Leq of 45 dB(A) will be reduced from currently over 7,000 to 4,000 despite the increase in traffic. This highly sophisticated airport planning and the elaborated solutions for a possible extension are communicated transparently within a discussion forum and on the respective internet platform as well. One reason why it was Kassel only, where the annoyance of NoiseCall users reduced, might be the fertile soil the tool has fallen upon.

Referring to the constructivism (cf. chapter 3.1.1), it is also possible that as Augsburg residents had already constructed solidly their reality and a stable (negative) perception of the airport management. The experiences with the

NoiseCall tool might not have been as coherent and multiple as it is necessary for a change according to the theory of constructivism.

The same explanation can be applied to the contentment with the airport's noise management. In Kassel the noise management of the airport comes close to ideal, as the management practices an open communication with the residents right from the start of the extension discussion. In this situation, the NoiseCall was installed, which again indicated the airport's concern for its residents and the will to let the community be part of the development.

The detected correlations as well as the results of the regression analyses are in line with Stallen's psychosocial model of annoyance (cf. chapter 2.5.6). In the current sample, perceived loudness correlates to a very high degree with annoyance. Stallen only picks up perceived disturbance. However, it might be possible that the differentiation of the constructs is not as easy for the interviewed participants. The noise management depicting the external processes in Stallen's model correlates to a high degree with the perceived annoyance in the current sample as well. In the model Stallen refers to "other attitudes" influencing annoyance via coping strategies and via the noise management. Referring to the data at hand, fearing a loss in the value of the homes and believing that noise impairs are promising candidates for Stallen's "other variables". The correlations with the actual noise load, noise sensitivity, and own flying behaviour are quite small on the other hand and can be excluded as moderators of annoyance.

The results are supported by the regression analyses. The acoustic variable noise load does not emerge as an important predictor for perceived annoyance. It is rather the way or the intensity individuals perceive loudness that affects annoyance. Apparently, non-acoustic variables play a major role in the generation of annoyance, yet, it might differ from situation to situation and airport to airport, which are the striking ones. One can imagine that in an area with less house owners – for example around Düsseldorf International Airport – the non-acoustic variable of the fear of a value loss will not be of significant importance.

In order to create an effective noise management the local circumstances of the respective residential area and the current relation of residents and airport management have to be taken into account.

It is questionable why users and non-users do not significantly differ regarding their annoyance, and yet one group makes use of the NoiseCall tool. Simultaneously, it needs to be discussed why the NoiseCall is only used by a minority of people.

Both facts might be traced back to personality reasons and to past complaint experience or experience with the relation of residents and authorities generally. Complaining can be viewed as just one way to cope with noise and its resulting annoyance. It is only one aspect of a spectrum of responses (van Wiechen, Franssen, de Jong & Lebret, 2002). However, Hume, Morley, Terranova, and Thomas (2002) consider complaining as the most frequent and immediate form of opposition as it is the easiest way to express someone’s concern. The more surprising is that in the investigated samples the NoiseCall as a non-bureaucratic and gratis way of complaining was not used more frequently.

Botteldooren, Lercher and Verkeyn (2003) revealed exposure to noise as a primary trigger for coping, but they also determined personal and situational factors as influential on the type and intensity of the coping behaviour. They state that “noise creates the possibility that a person is coping, but does not predict the act itself”.

Understanding the motivation behind complaining and not complaining is linked with great difficulties as many factors come into play to determine who is annoyed and if that annoyance finds expression as a complaint to the airport or to official authorities.

Borsky (1979) defined complaining as a function of many factors:

- Knowing *where* to complain
- Believing that the complaint might be *effective*
- Confidence in one’s ability to deal with authorities
- Past complaint experience

The factor of not knowing where to complain can be excluded as explanation for the low NoiseCall use because all participants have received a letter with an explanation of the NoiseCall and the phone number. However, the other aspects might serve as an explanation, why so few people have used the service and why the annoyance of the users was generally not reduced.

Low effectiveness (in terms of the NoiseCall will have no consequences) and a *low expectancy of success* (either there is nothing to be done about the noise or if there is, authorities will still not do it) seem to be crucial factors. In a Brisbane community noise survey, 66 % of the people reporting to be seriously affected by noise did not complain with the major reason that they considered there was *nothing that could or would be done* about the noise (Henry & Huson, 2003). Avery (1982) quotes this reason for 31% of his subjects. A social survey reported by Hume and Thomas (1993) indicated that many individuals cope or *'put-up-with'* the disturbance, rather than complain, because they assumed that their complaint would not significantly change the airport's operations. Also, in a more recent study, van Wiechen et al. (2002) report the *low expectation of success* as a major reason for the disparity between underlying feelings of annoyance and actual complaint behaviour. Borsky (1979) thought people only would complain to public authorities about noises which they believed the authority to have *influence* on. Avery (1982) concludes that among other reasons residents not having telephoned to complain about noise are *not sufficiently annoyed* by the noise. Van Wiechen et al. (2002) point out apart from noise levels and noise annoyance the following factors to motivate (some) people to complain: *sleep disturbance*, *concern about health*, and *fear* for aircraft crashes. Hume et al. (2003) mention that complaints depend partly on the *time of day* the noise occurred; *owning a house* is also considered as one crucial factor for complaining. Moreover, levels of complaints are also dependent on the way different airports deal with noise complaints (differences in the efficacy of systems, community awareness) and how busy individuals are (Hume et al., 2003). Being busy might keep the residents from actually complaining and also draws the attention away from aircraft noise. Hume et al. (2003) revealed significant night-time sensitivity: Late evening, night-time, and early morning noise generate the most complaints because of the reasonable expectation "that individuals in their own homes could expect to be allowed a 'good nights sleep'".

Individual differences and personal thresholds apply to aircraft noise as to all stressors in general. Differences in the response to noise and the threshold for being sufficiently annoyed to complain directly to the airport therefore vary considerably (Job, 1996). The *individual threshold* already constitutes one factor to determine the relationship between annoyance and complaint behaviour. The status of being sufficiently annoyed to be at one's threshold to complain also depends on the overall status of the person: If an individual is already strained due to other reasons than noise, aircraft disturbances might be experienced as more annoying than usual and therefore the person is more likely to lodge a complaint.

To explain – at least partly – the variance in people's annoyance reactions Weinstein (1980) defined a so called *critical-uncritical dimension*. He found this dimension to explain 32 % of the variability. Some people judge their entire surrounding (not only noise) more critical than others. The author stresses that people who are critical are not necessarily indiscriminate complainers. People scoring higher in critical dimension gave more differentiated judgements, accordingly to Weinstein's findings. The author sums up that there is no support for the notion that environmental critics are chronic complainers whose opinions should be disregarded. Weinstein puts forward that people at different ends of the critical-uncritical dimension *do not really feel differently* about their neighbourhood, but do *differ in their willingness to express* criticisms in the context of a door-to-door interview.

With the concept of "*negative affectivity*", Winneke, Neuf and Steinheider (1996) show a similar train of thoughts. Negative affectivity is defined as generalised tendency to complain and to express discomfort any time and across situations. It is strongly correlated with personality traits, such as trait anxiety, neuroticism, and repression sensitisation (which was not found to be true for trait annoyance).

The aspect of personality and its role in complaint behaviour depicts the focus of the next study section.

7 Personality studies

The second part of the thesis is dealing with the aspect of personality. Possible personality differences of users and non-users are investigated. As outlined in the discussion above, personality might play a role in annoyance generation, but might as well influence the coping strategies.

It can be assumed that annoyed residents, with a particular personality, rather express their annoyance, in contrast to others, who might be annoyed and yet do not express their annoyance.

Airport authorities have repeatedly mentioned the different personalities of their noise line callers. Some of them are described as very aggressive or even neurotic. Some of them even got prosecuted for harassing the noise line officer (personal communication: Airservices Australia).

For the current studies it is assumed that users and non-users differ in their personality in general and in their anger expression specifically. Non-users follow a suppressive or palliative coping style and it is therefore hypothesised that they have higher anger-in values than users (cf. chapter 8.4.2). Users experience annoyance and express it in a controlled manner by calling the noise line. Bongard and al'Absi (2003; 2005) found that the anger expression styles differ depending on the different social domain a person is in. Anger expression is adapted to social demands. For example anger expression is rather low at the workplace, whereas anger is expressed more frequently at home.

The differentiation of anger expression in specific domains (at home, at work, during free-time) is picked up in the Dortmund study. It is assumed that the anger is expressed more openly at home, because aircraft noise is usually more bothersome, when people are looking for recreation at home. In case they are at work or away from home during free time, aircraft noise is not as bothering, because it is not breaking down their home territory barriers (chapter 2.5.6).

Add to the different anger expression styles in the specific domains, Bongard and al'Absi (2003; 2005) found a gender difference depending on the domains. Women expressed their anger more openly at home compared to men. Whereas at work, Bongard and al'Absi found men to report more open anger expression.

Due to these findings, the aspect of gender is considered as well in the analysis.

The investigations at Dortmund and Sydney Airport were dedicated to the question to what extent personality variables play a role in the expression of annoyance.

8 Investigation Areas and Method

8.1 Description of Research Areas

8.1.1 Dortmund Airport

Dortmund Airport has, like Augsburg-Mühlhausen, developed from a sporting field founded in 1926. By now Dortmund offers destinations to 13 European countries. Passengers increased from 72,867 in the year 1980, to 677,400 in 1999, and in 2004 Dortmund had over one million passengers. 45,134 movements are expected for the busiest six months of the year 2010 (Wölk, 1994). In 1983, an 850 m runway was opened, but was extended to 1,050 meters only 5 years later. In 2000, the new terminal was opened and the runway was extended again to 2,000 meters. The location in a densely populated area constitutes a serious problem. Due to the slice-by-slice extension, the people living in the vicinity of the airport naturally have developed great mistrust of the airport management and politicians. The airport applied for the licence of 160 landings after 2200 hours in the six busiest months of the year to meet the demands of charter airlines. This would break a long-held ban on nocturnal flights.

Table 19: Dortmund Airport – index data 1998 – 2003

	1998	1999	2000	2001	2002	2003
departures/ arrivals	44,221	45,184	45,131	46,272	41,690	37,879
passengers	610,640	677,400	719,365	1,064,149	994,508	1,023,339
fright (t)	1,076	5,359	6,722	5,518	5,550	5,267
jobs	977	1,092	1,393	1,622	1,581	1,338

8.1.2 Sydney Airport

Sydney Kingsford-Smith International Airport was founded in 1920. In 1924 the regular air service between Sydney, Melbourne, and Adelaide was established. The first flights from England took place in 1928 and 1930. In 1941 a massive development commenced with the construction of two sealed runways. Pan Am was the first airline to have scheduled flights to Sydney. The first extension of the north-south runway commenced in 1963, followed by a further extension for the B747, and Concorde five years later. 1989 was the year for the approval of a third runway to be constructed; it opened in 1994. For the Olympic Games in the year 2000 AU $2 billion was spent on the upgrade and expansion of the international and domestic terminal. Accordingly, Sydney Airport today consists of three runways:

- Two north-south runways (main: 16R/34L – 3,962 m; parallel: 16L/34R – 2,438 m) [16L and 16R used by aircraft landing or taking off towards the south; 34L landing or taking off towards the north; 34R landing towards the north and taking off to the east]
- One east-west runway (07/25 – 2,529 m) [landing or taking off towards the east; 25 landing or taking off towards the west].

Sydney Airport has one international terminal (T1) with 34 aircraft gates as well as three domestic terminals (T2, T3, Express). T3 has 18 gates, the Qantas

Terminal offers 13 gates and there are five express gates. For cargo three international and two domestic terminals are available.

In 2001/02 Sydney Airport served 23.9 million passengers, 35% international and 65% domestic. Aircraft movements during this time period were 254,729 totally, with 18% international flights, 79% domestic, and 3% freight flights (Table 20).

Table 20: Sydney Airport – passengers and movements (2001/2002)

Passengers (2001/2002)		Aircraft movements (2001-2002)	
Total	23.9 million	Total	254,729
International	8.4 million (35%)	International	45,795 (18%)
Domestic	15.5 million (65%)	Domestic	201,405 (79%)
		Freight	7,529 (3%)

(peak hours with more than 8 movements per hour at the moment: 0700 – 1200 and 1500 to 2000)

Sydney Airport is of great economic importance: 42,000 jobs are directly associated with the airport. Together with jobs at companies around the airport there are 150,000 directly and indirectly related jobs. This makes 12% of all working residents in Sydney. In September 2001, the national airline Ansett experienced a total collapse and was grounded with an estimated AU$2.8 billion worth of debts. After the Ansett collapse Virgin Blue (low cost carrier) emerged and Qantas actually increased its fleets. Now, Qantas has 120 of its own jets, and over 200 with associated airlines. Qantas, after KLM, is the 2nd oldest airline.

In 1953, Sydney was the 2nd busiest airport in the world, today it is only the 42nd busiest.

Qantas has a new cargo jet, the 777-300 extended range. It weighs 410 tons at take-off, with half of the weight being fuel. Qantas will also buy the A 380 as the largest aircraft in the world.

In Sydney, fees for noisier aircrafts (e.g. 727 DHL) are collected. At Sydney Airport, Airservices Australia is dealing with all noise related issues.

8.2 Conjectures

The theoretical delineations of this study lead to the following conjectures and hypotheses.
It is hypothised that

H1

- users and non-users differ in their personality, i.e. their anger expression style,

H2

- non-users follow a suppressive coping style and can be characterised by higher anger-in values,

H3

- users express experienced annoyance by calling the noise line,

H4

- anger is expressed more openly at home,

H5

- women express their anger more openly at home compared to men,
- men express their anger more openly at work.

8.3 Dependent and Independent Variables

The usage of the NoiseCall (in Dortmund) and lodging a complaint at Airservices Australia (in Sydney) as well as the gender depict the independent or rather classification variable. The group of the users and the non-users and men and women respectively are differentiated.

The anger expression in general and in the particular locations (at home, at work, during free time) depict the dependent variables. The dependent variables are assessed by the State Trait Anger Expression Inventory (cf. 8.4.2).

8.4 Methodology

For the second empirical part of the thesis, two studies have been conducted: The Dortmund study included the installation of the NoiseCall (as in part I), the Sydney study solely investigated the personality. In Sydney, the assessment of users and non-users of the local noise line was done in co-operation with Airservices Australia (for details cf. section 8.4.3).

In both cases the anger expression style is assessed. However, the domain specific expression is at hand only for the Dortmund study, because the ethics committee at Sydney University found the domain specific questionnaires too much workload for the subjects and the subjects were indeed unwilling to spend more than 10 minutes in an interview. Also, the author has been very restricted in acquisition methods due to ethics committee's demands.

8.4.1 Sample characteristics

Among the 119 (67 men and 52 women) Dortmund subjects, 12 (11 men and 1 woman) actually used the NoiseCall. The others did not make use of the service, because they were either not annoyed, or sceptical about the use of the tool. The participants were, on average, 51 years old (SD=15.2). Users were slightly older (57 years compared to 50 years) than non-users, however, this difference was not significant ($t_{(115)}$= -1.36; p=.176). Just one user rents his home, which equals 8.3%; 16.8% of the non-users (18) do not own a home. Owners fear a property value loss moderately to quite (M=3.6; SD=1.6). Users (M=4.4; SD=1.3) and non-users (M=3.5; SD=1.6) do not significantly differ in this respect ($t_{(98)}$=0.10; p=.069).

In Sydney 30 residents took part in the investigation. Not all data are available for the analyses, because not all participants were willing to answer the State-Trait Anger Expression Inventory (STAXI). Some participants questioned the relation of personal questions with investigations about noise. Even though the author explained why it is important to investigate this issue, some participants only answered the noise related questions.

13 women and 17 men took part, whereby 10 women and 13 men had lodged a complaint at Airservices Australia. The total sample was 55.9 years old on average (SD=14.1); the non-complainers were slightly younger (51.3; SD=21.1), but not significantly ($t_{(27)}$= -0.79; p=.439).

Only one person of each group did not own the home. For the non-users this depicts 16.6%, for the users this is a percentage of 4.5%. The distribution equals the one in Dortmund. Owners feared only a slight/moderate loss in the value of their homes (2.4; SD=1.7), but the two groups differed significantly in this respect ($t_{(23)}$= -2.37; p=.027). Non-complainers (1.0; SD=0.0) feared no value loss, whereas users feared moderate value losses (2.8; SD=1.7).

8.4.2 Instruments

The following methods and instruments were used:

In Dortmund the half-standardised interview of the NoiseCall studies has been used as well. In Sydney an adopted and shortened version comprising questions of loudness, annoyance, ownership, complaining, noise sensitivity, hazardousness, fear, health status has been applied (cf. appendix p. 157 ff.). All questions were assessed on the five point Rohrmann scale and a translated pendant, respectively (1-not at all, 2-little, 3-moderately, 4-quite, 4-very).

The State-Trait Anger Expression Inventory (STAXI) (Spielberger, 1988) was used in the Sydney study; the modified version for domain-specific anger (Bongard & al'Absi, 2003; 2005) in the Dortmund study. The STAXI consist of three subscales referring to state anger, trait anger, and anger expression. Anger expression is subdivided in three factors: anger-in, anger-out, and anger control. Anger-in measures how frequently anger feelings are suppressed and not shown to the outside world. Anger-out records how frequently anger is directed towards others or objects. Anger control is an indictor for the frequency of attempts to control anger or to not let anger arise (Schwenkmezger, Hodapp & Spielberger, 1992).

Trait anger is assessed by 10 items, which are divided in trait temperament and trait reaction. The anger expression scale comprises 24 items. Therefore, each of the subscales (anger-in, anger-out, anger control) consists of 8 items. All

scales, even the subscales, have four levels: almost never (1), sometimes (2), often (3), almost always (4). The values of the respective items are added as the items are unidirectional. The maximum value of trait anger therefore is 40, the minimum 10. The trait subscales have their minimum at 5, their maximum at 20. The maximum for the expressions scales is 32, the minimum 8.
The domain-specific version of the STAXI (Bongard & al'Absi, 2003; 2005) is modified in a way that it no longer asks for general reactions and behaviours, but for reactions and behaviours, when the person is at home, during free time away from home and at work or university/school. Apart from this modification, the original version is kept.

8.4.3 Procedures

Basically, the same procedure as in the NoiseCall studies has been followed in Dortmund. However, face-to-face interviews were conducted in Dortmund with 120 residents. The interview combined standardised ratings about e.g. annoyance and activity interference with half-structured questions concerning attitudes towards the noise producer and desired counter-measures (chapters 4.6, 4.7 and Table 1). After the interview the STAXI referring to domain-specific anger expression (Bongard & al'Absi, 2003; 2005) was handed to the interviewees together with a free return envelope.
Like at the other German airports, possible participants were selected in a way that other noise sources were excluded and that residential areas with low and high noise load were included. The noise levels varied from low noise areas (39.6 dB(A)) on the one hand to moderate exposure on the other (53 to 58 dB(A)). The described NoiseCall (cf. section 4.7) has been installed for 8 weeks.

The procedure at Sydney Airport was different. Within the framework of a scholarship of the German Academic Exchange Service (DAAD) a co-operation study between the Universities of Dortmund and Sydney was planned. It was intended to repeat the German studies, draw international comparisons about the NoiseCall and investigate the personality of complainants vs. noncomplainants. However, this particular proceeding was rejected due to various reasons (e.g. an excellent professional service line including an internet platform already existed at Sydney Airport). Therefore, the project concentrated on personality differences between complainers and non-complainers. The project was made possible also due to the supervision of Dr. Julie Hatfield and the excellent co-operation of Airservices Australia.

Airservices Australia, which is running the noise service at Sydney Airport, invited residents using the service to take part in the study. According to a written guideline (cf. appendix p. 156) the person in charge explained the background and intention of the study. Once the resident approved, Airservices Australia passed on the respective data to the author of the thesis. Afterwards, the author conducted telephone interviews according to the half-standardised procedure (cf. Table 3) and the STAXI with the volunteers. In order to select and gain a control sample, residents living in the same suburb and in the same street were taken from the phonebook and contacted by cold calling. The control sample is small, as not many residents were willing to participate. The same telephone interview was conducted with the controls but it was made sure that they had not lodged a complaint at the Airservices Australia service line. In Sydney the domain-specific anger expression style could not be assessed (ethic committee at Sydney University). Therefore, it has been reduced to the general anger expression style.

8.4.4 Data processing

The STAXI data have been processed according to the analysis code: Trait anger, anger-in, anger-out, and anger control have been calculated by adding the corresponding item values for each subject (chapter 8.4.2).

9 Results

At first, the results of the personality differences of users and non-users are described. Secondly, gender differences are investigated, because anger expression styles are different in men and women (Bongard & al'Absi, 2003; 2005).

9.1 Anger expression – user and non-user

9.1.1 Dortmund study

Users (M=25.9 years of residence; SD=15.1) have been living in their areas slightly longer than non-users (M=20.9; SD=13.4), however, not to a significant degree ($F_{(1; 117)}$=1.47; p=.227). Users reported to fear a loss in the value of their homes moderately to very (M=4.4; SD=1.3), whereas non-users reported less fear of a loss in property value (M=3.5; SD=1.6). This difference, however, was not significant ($F_{(1;98)}$=3.39; p=.069). Both groups reported to fly, on average, one to two times per year ($F_{(1; 117)}$=0.19; p=.667).
The groups did neither differ in their self-reported fear of health impairments due to noise, nor in their contentment with the own health status, or the noise sensitivity.

Table 21: Means M and standard deviations SD of potential noise-effect moderators in Dortmund

		N	M	SD
Health impairment due to noise	User	12	2.00	0.00
	Non-user	107	1.93	0.28
Contentment with own health status	User	12	3.67	0.65
	Non-user	107	3.60	1.13
Noise sensitivity	User	12	3.00	1.35
	Non-user	107	2.91	1.05

Table 22: Results of the one-way ANOVAs of potential noise-effect moderators in Dortmund

	df	F	p
Health impairment due to noise	1; 117	0.63	.428
Contentment with own health status	1; 117	0.04	.838
Noise sensitivity	1; 117	0.08	.777

df=degree of freedom

In order to meet the demands of the analysis of variance, again the method of matched samples (cf. section 4.7) is applied: for each user a non-user was selected, matching in gender, age, and noise exposure.

In Dortmund, only 10 users have been willing to answer the STAXI items. Therefore, the matched sample in Dortmund comprises 20 cases.

In order to detect the assumed personality differences (differences in anger expression) of users and non-users a multivariate analysis of variance is conducted. The multivariate analysis is proposed for dependent variables that correlate (Bühl & Zöfel, 2002). This fact is stated for the subscales of the STAXI (Schwenkmezger, Hodapp & Spielberger, 1992).

The gender variable was not included in the analysis of variance as there are only two women (one user, one non-user). Therefore, the analysis was conduced with the group factor (usage) and the dependent variables (anger-in, anger-out, anger control generally, at home, during free time, at work).

Table 23 shows the mean values and standard deviations for the STAXI scales for users and non-users separately. In regards to the descriptive data, there are slight differences between the two groups, with the biggest differences in all anger-in values. The users feature smaller anger-in values. Also the differences in anger control values (higher for users) were in the expected direction. However, their magnitude was smaller.

Table 23: Descriptive Statistics

		User		Non-user	
		M	SD	M	SD
general	**anger-in**	**17.0**	3.20	**20.9**	4.48
	anger-out	11.9	3.35	13.6	4.75
	anger control	22.8	3.19	21.6	3.78
during free time	**anger-in**	**15.3**	6.11	**19.9**	5.57
	anger-out	9.9	1.66	13.0	4.14
	anger control	24.2	3.97	21.9	3.91
at home	**anger-in**	**15.7**	5.58	**19.5**	5.26
	anger-out	11.4	2.80	13.1	4.14
	anger control	23.1	3.54	22.1	3.09
at work	**anger-in**	**17.7**	3.65	**20.9**	5.84
	anger-out	11.8	3.97	12.6	4.53
	anger control	25.2	4.64	23.8	3.58

The analysis of variance reveals no main effect of the group ($F_{(12,5)}$=1.22; p=.441). It cannot be verified that users and non-users generally differ in their anger expression.

Table 24 depicts the results of the analysis of variance for the anger expression scales.

The descriptive differences – against the assumed direction – are not significant. Significant differences exist in the tendency of non-users to rather keep anger inside and suppress feelings in general.

This is in line with the assumptions. The found discrepancies in the descriptive data that this would also be true for the three areas (free time, home, work) proved not significant.

On the contrary: for the domain free time and the subscale anger-out the results oppose the expected general direction: during free time, away from home or work, non-users tend to express their anger against others or objects more than users.

Table 24: Results – analysis of variance: anger expression

		df	F	p
general	anger-in	1	4.75	.045*
	anger-out	1	0.82	.379
	anger control	1	0.51	.484
during free time	anger-in	1	2.69	.120
	anger-out	1	4.72	.045*
	anger control	1	1.46	.244
at home	anger-in	1	2.17	.160
	anger-out	1	1.03	.325
	anger control	1	0.38	.548
at work	anger-in	1	2.0	.177
	anger-out	1	0.17	.686
	anger control	1	0.53	.478

In summary:

The differences in the descriptive data can only be supported partly by the inferential statistics. Users can be characterised as less anger-in (general) and less anger-out (during free time) then non-users. The first result is in line with the assumptions as anger-in behaviour means a suppression of anger feelings, whereas users express their emotions on the phone. They find a way to air their concern.

The finding that non-users feature higher anger-out behaviour during free time seems quite surprising. Anger-out means an expression of anger that can be directed verbally or physically against other people or objects.

9.1.2 Sydney study

Users of the Sydney noise line have been living at their respective homes for 20 (SD=16.0) years on average. Non-users have been living there only for 15 years (SD=13.7), this difference, however, was not statistically significant ($F_{(2;26)}$=1.39; p=.266).

Users and non-users do not significantly differ in their perception of how hazardous noise is, nor in their contentment with the own health status, or their noise sensitivity (Table 25 and Table 26).

Table 25: Means M and standard deviations SD of potential noise-effect moderators in Sydney

		N	M	SD
Hazardousness of noise	User	22	4.09	1.15
	Non-user	6	3.33	1.37
Contentment with own health status	User	22	3.82	1.05
	Non-user	6	3.67	1.03
Noise sensitivity	User	22	2.89	1.09
	Non-user	6	3.50	1.52
Worries about a possible plane crash	User	23	2.70	1.36
	Non-user	6	1.50	0.84

Yet, how much they fear or worry about possible plane crashes divides the two groups almost significantly (p=.052): non-users fear this not at all to little (1.5), whereas users fear this moderately (2.7).

Table 26: Results of the one-way ANOVAs of potential noise-effect moderators in Sydney

	df	F	p
Hazardousness of noise	1; 26	1.89	.181
Contentment with own health status	1; 26	0.10	.756
Noise sensitivity	1; 26	1.27	.181
Worries about a possible plane crash	1; 26	4.14	.052

df=degree of freedom

In contrast to the investigation procedures at the German airports, the Sydney users and non-users have not been matched because the number of users was not, like in the German groups, the limiting factor. In fact, with 22 users we have a sound sample size here. The small non-user group (6), however, is problematic. No group was big enough to facilitate data reduction due to a matching procedure. Moreover, as mentioned before, in Sydney the STAXI subscales at home, at work, and during free time have not been assessed as the participants were not willing to do so.

Looking at the descriptive data (Table 27), the biggest difference between users and non-users exists in the subscale anger control: users feature a higher anger control, which is in line with the assumptions.

The trait anger value of the Sydney users is higher than that of the non-users. Furthermore, the anger-in is higher in the user sample, which contradicts the findings in the Dortmund sample and the assumptions.

Table 27: Means M and standard deviations SD – Sydney STAXI

		User		Non-user	
		M	SD	M	SD
trait	anger	14.87	3.89	13.50	2.59
general	anger-in	13.18	3.79	11.83	3.49
	anger-out	12.90	3.48	11.83	3.25
	anger control	**28.58**	3.13	**26.67**	2.73

The analysis of variances, however, proves none of the descriptive differences statistically significant (Table 28).

Table 28: Results – analysis of variance: STAXI

		df	F	p
	trait anger	1	0.64	.431
general	anger-in	1	0.60	.447
	anger-out	1	0.44	.515
	anger control	1	1.79	.194

In summary:

The differences in the descriptive data cannot be supported by the inferential statistics. The anger control values of users – that would be assumed to be higher – are not significantly different compared to the non-users group. It has to be kept in mind that the sample of the non-users is less than one third of the number of users. It is indicated to assess a bigger sample with equally distributed users and non-users.

9.2 *Anger expression – gender*

When dealing with and investigating anger expression, one important aspect is the gender. Gender apparently plays a vital role in the generation and the expression of anger and aggression (Campbell, 1993). The gender variable has not been included in the previous analysis due to the small sample sizes. Therefore a separate analysis was done to detect gender differences irrespective of the usage of the NoiseCall.

9.2.1 Dortmund study

In order not to loose data, the gender difference in Dortmund has been analysed with a bigger sample as this was not dependent on the usage of the NoiseCall (the subdivision of users and non-users in men and women would have been preferred, but there was one female user only).

Of the total 120 subjects in Dortmund, 60 answered the STAXI items, 33 men and 27 women. This subsample is used for the analysis of a gender difference.

Table 29 shows the mean values and standard deviations in anger expression for both groups. Women have higher values in anger control at work, yet the difference is only marginal.

All other values are higher for men. The biggest differences exist in the following aspects: anger control at home, anger-in (general), anger-in at home, and anger-in in the other two domains. Men also show higher anger-out values in all domains, but these are smaller compared to the anger-in differences. Men apparently show more anger control at home and can be characterised by higher anger-in values in general and in all domains.

Table 29: Means M and standard deviations SD– STAXI men and women

		men		women	
		M	SD	M	SD
general	**anger-in**	**19.18**	4.04.	**16.37**	5.31
	anger-out	14.27	3.46	12.96	3.72
	anger control	23.06	3.54	21.96	4.01
during free time	**anger-in**	**17.57**	5.06	**15.37**	5.12
	anger-out	12.03	3.58	11.22	2.64
	anger control	23.85	4.27	22.19	4.38
at home	**anger-in**	**17.97**	4.31	**15.44**	5.27
	anger-out	13.21	3.56	12.67	3.46
	anger control	**23.94**	4.12	**20.89**	4.67
at work	**anger-in**	**19.33**	4.80	**17.22**	5.01
	anger-out	12.00	3.02	10.30	1.64
	anger control	24.79	3.40	25.67	4.44

Table 30 shows the ANOVA results for the gender effects in anger expression. The difference of men showing more anger-in generally turns out to be significant (p=.023), as well as the higher anger-in values at home (p=.046) and anger control at home (p=.038). Additionally, anger-out at work is significantly higher for men (p=.011). Anger-in at work and anger-in during free time emerges as not significantly higher for men.

Table 30: Results of the analysis of variance – gender effects STAXI Dortmund

		df	F	p
general	anger-in	1	5.42	.023*
	anger-out	1	1.99	.163
	anger control	1	1.26	.265
during free time	anger-in	1	2.80	.100
	anger-out	1	0.95	.333
	anger control	1	2.20	.143
at home	anger-in	1	4.17	.046*
	anger-out	1	0.36	.552
	anger control	1	4.53	.038*
at work	anger-in	1	2.76	.102
	anger-out	1	6.91	.011*
	anger control	1	0.69	.408

In summary:

In general, men reported significantly more anger-in behaviour, meaning they experience anger, but do not express it. For the study at issue, in which people were sampled with respect to the noise load at home, this domain is the most interesting. Here again men reported more anger-in than women, while women rated less control of their angry feelings

9.2.2 Sydney study

In the Sydney investigation 17 men and 13 women participated. However, only 14 men and 12 women answered the STAXI items.

Table 31 contains the mean values and standard deviations of the STAXI scales for men and women. Men are characterised by less trait anger. The other values differ marginally only.

Table 31: Means M and standard deviations SD – STAXI gender effects Sydney

		Men		Women	
		M	SD	M	SD
	trait anger	**13.21**	1.76	**15.96**	4.55
general	anger-in	12.57	3.69	13.54	3.82
	anger-out	12.71	2.79	12.42	4.01
	anger control	28.36	3.71	27.75	2.14

However, the analysis of variance revealed no significant main effect of gender ($F_{(4,21)}$=1.08; p=.392).

Table 32 shows the results of the analysis of variance for the subscales. Men and women do not differ significantly in their anger expression, yet they do in their trait anger. In this Australian sample women showed more trait anger than men.

Table 32: Results of the analysis of variance – anger expression

		df	F	p
	trait anger	1	4.36	.047*
general	anger-in	1	0.43	.517
	anger-out	1	0.49	.826
	anger control	1	0.25	.622

In summary

Men and women do not differ significantly in their anger expression styles in general. This finding suggests an opposite gender difference in the Dortmund and Sydney sample. Australian men showed significantly less trait anger then women. However, the trait anger values are considerably low altogether. The results are discussed in the next section.

9.3 Discussion

9.3.1 Users and non-users

Generally, users in Dortmund and Sydney fear a loss in the value of their homes significantly more than non-users. The Sydney users fear or worry about possible airplane crashes (almost) significantly more than non-users. Both aspects find correspondence in the psychosocial model of annoyance (chapter 2.5.6). The results thus support that non-acoustic factors are related to annoyance or in this case to complaint behaviour. In other features such as noise sensitivity the two groups do not differ, therefore these factors obviously are not of much importance in this respect.

In terms of personality, to be precise in terms of anger expression, users and non-users significantly differ in their anger-in values in general and their anger-out values during free time. In the other aspects they do not differ significantly. Users can be characterised by less anger-in, less suppression of anger emotions and more expression of angry feelings.

This is in line with the hypothesis as one would assume that users find a way in using the NoiseCall to express their angry feelings. One also would assume that users have higher anger control values and they find an avenue to air their concern or similar feelings. This view cannot be supported statistically by the Dortmund sample. Only the descriptive data of both the Dortmund and the Sydney sample are in line with this view.

Interestingly, in the Dortmund sample non-users show significantly higher anger-out values during free time. Residents, who did not make use of the NoiseCall, can be characterised by a higher expression of anger against others while away from work and home.

This result is rather surprising, and yet, it might reveal the importance of the personality assessment on the one hand, and the differentiation in specific domains of anger expression on the other hand.

A possible interpretation – as also the descriptive data indicate higher anger-out values for non-users – might be that for non-users the NoiseCall is not of the first choice as a controlled way to express anger. Anger-out is defined as anger expression against others or other objects, in physical or verbal attacks like criticism or verbal harassment. As the anger-out is only significantly higher in the domain free time, it can be assumed that this is due to social restrictions at home or at work.

The Sydney descriptive data partly support and partly contradict the Dortmund findings. Once again, users show more anger-in and more anger control (general), both of which is in line with the assumptions. However, the anger-out value of Sydney users is slightly higher than the one of non-users.

Both samples, however, are relatively small, especially the non-user subsample in Sydney and the user sample in Dortmund. It is recommended to get further insight into the personality differences among residents who do and do not use a tool like the NoiseCall to investigate this issue with bigger samples. It would also make sense to subdivide the bigger sample into a 2x2 matrix: highly and little annoyed residents, who used and who did not use the NoiseCall. This design would shed light on the role of personality and anger expression in terms of annoyance coping:

	usage	non-usage
high annoyance	high annoyance usage	high annoyance non-usage
low annoyance	low annoyance usage	low annoyance non-usage

Figure 9: Proposed design

To sum up, the investigation of personality differences seems to be promising. This investigation is important for various reasons. From the Type A behaviour discussion as well as from the role of anger expression in the generation or modulation of diseases (e.g. hypertension), we know about the individual and societal importance.

Another important aspect is to recognise and accept personality differences and that different people might long for different treatments. In order to meet the demands of different people, service providers or airports have to consider the differences and find alternative ways to handle annoyance. By doing so, the relation of the two systems (residents and airport) can be improved: as discussed before the same instrument might be appropriate in the one situation (Kassel-Calden) but not in the other (Augsburg).

9.3.2 Men and women

The results of the Dortmund sample concerning gender differences are somewhat surprising. From a descriptive point of view, men tend to have higher values in all anger expression styles in all domains. The anger control at work depicts an exception (the difference is not significant though): women control their anger at work slightly more then men. In the domain of work, men are characterised by significantly higher anger-out behaviour. Both aspects are in line with other studies (Bongard & al'Absi, 2003; 2005) and might be traced back to the socialisation aspects and socio-biology respectively. Women – still – are in positions at work of lower social status. Therefore, a woman's anger expression at work might be sanctioned rather then that of a man. From the socio-biological perspective, work is the domain of men, where they have to prove themselves as bread-earners. Also, male aggression (Campbell, 1993) is of different quality then female aggression. Men define aggression as competition to beat rivals. The work domain constitutes such an area of competition. However, one would assume such relationship also in people's free time. This cannot be detected for this sample.

The data found in the domain at home can be interpreted in a similar direction. Women suppress and control their anger at home less then men. Even though we are living in the 21st century, women seem to understand themselves as "rulers of the home". This is their traditional domain. Their social role puts them in charge of the home duties and of raising the children. In addition to the socio-biological perspective, which demands the protection of the children, this would explain women's higher anger suppression and men's control at home.

The assumption that still women are responsible for "homework" leads to the explanation that women are more stressed at home then men and men are more stressed at work then women. Therefore, both groups do not control or suppress their anger-in these areas as these strategies of coping are not effective. Men also might control or suppress their anger at home because this is their relaxation and quality time. They might not want to spoil it or rather – as their work is over – angry feelings can be controlled or suppressed in a better way.

Surprisingly, men in this sample suppress their anger more then women in general. In the STAXI manual (Schwenkmezger, Hodapp & Spielberger, 1992) as well as in findings of Bongard and al'Absi (2003; 2005) men and women show no significant differences in their general anger expression. Especially, the anger suppression of men is interesting, as one would assume a higher degree of anger expression among men in general. This would fit the stereotypical picture of men being the more aggressive gender. Maybe, this finding is due to social desirability. Unfortunately, a social desirability scale has not been applied. This is recommended for further investigations.

In the Sydney sample men and women do not differ significantly in their general anger expression styles. This corresponds to Bongard's and al'Absi's (2003; 2005) findings (and the STAXI manual) that men and woman only differ in their domain specific anger expression. From the descriptive point of view, Sydney men show less anger-in behaviour, but more anger-out and control.

In Sydney, the trait anger was calculated additionally. Women state significantly more trait anger then men, meaning that they would rather show state anger-in an anger provoking situation. Again, this result is rather surprising because men tent to have the social role of the aggressor. But it has to be considered that men and women get angry for different reasons and display their anger-in a different way (Campbell, 1993). Men are aggressive to demonstrate their masculinity, whereas women become aggressive when they cannot control their temper anymore. The STAXI might contain items women find their way of aggression in. Still, the trait anger data in Sydney are considerably low for both groups.

Unfortunately, the domain specific anger expression could not be assessed in Sydney. Therefore, the cultural differences cannot be described. Bongard and al'Absi (2003; 2005), however, state that the gender-specific anger expression features high intercultural similarities. Moreover, the Sydney study contains only few subjects. Hence, the results should be handled with care.

10 Conclusion and prospect

To sum up, the NoiseCall as a tool to design the socio-organisational interface of residents and airport management is not as effective as assumed. Apparently, the NoiseCall can be effective if it is put into practice right from the start as it has been the case in Kassel. Here, the tool met the objectives of participation and information at the same time. In the other case (Augsburg) the relation between both parties seemed to have already been determined by mistrust and the NoiseCall has not been perceived as a possibility to participate in a mutual process. Co-operation from the beginning (e.g. of an airport extension plan) and information creates a relation of trust. In such a situation, a tool like the NoiseCall can achieve its goals, because it is not questioned whether it simply is an instrument to sooth the residents' minds, for example.

In Kassel the airport management handled the issue of the airport extension very well: the different possibilities were communicated to the public. The contentment with the management as well as with the local politicians increased. Apparently, the residents appreciated the close co-operation of the airport with local authorities.

In Augsburg the NoiseCall did not reach the assumed goals. It is possible that in this particular situation the NoiseCall would have had to be installed for a longer period of time. Referring to the theory of constructivism (cf. chapter 3.1.1) it needs coherent and multiple experiences to change the perception of a person. To change the residents' perception positive consequences (for example change of flight path) also need to be better communicated to the public.

In Kassel for example, if necessary or desired by the caller, the airport or air traffic control services were contacted and further information was obtained and passed on to the resident. During the back ring, single residents reported that in the meantime the situation had improved. It was the impression of the operators that tower controllers were reminded of noise reducing flight manoevres and accordingly gave instructions to the pilots (Maziul & Vogt, 2002).

Furthermore, other trust-building measures probably have to be conducted as this might be the crucial point why the NoiseCall did not attain the goal of annoyance reduction.

However, it also has to be considered that Kassel Airport is the smallest of the investigated. So the effectiveness and usefulness of the NoiseCall is – so far – restricted to small-sized airports.

The described correlations of annoyance and the results of the regression analysis once again stress the importance of the consideration of other then acoustical factors. Comparing the results with the existing literature it becomes apparent that depending on the situation different factors are more important than others. In this case it was the perceived loudness (not the acoustic measure leq), the fear of a loss in the value of the homes, and the contentment with the politicians' noise managment. In order to create a good relation, it is important to know the specific aspects of concern. Under these circumstances it is essential that the airport management knows about this fear and to give residents trustworthy information on this issue. By doing so, unrealistic worries can be avoided. It has to be determined for each airport separately, which factor is the most important.

When interpreting the study results, it has to be kept in mind that the group of residents, who actually used the NoiseCall, is considerably small. The low number of participants might be a result of the residents' learned helplessness. The construct has been discussed in chapter 2.5.4.4. It is possible that the residents have repeatedly made the experience of no control of the noise event. For example, they might have lodged complaints (before the installation of the NoiseCall) and experienced no consequences whatsoever. As a result they might have internalised their inability to do something about the nuisance and developed personal passivity for future situations. This passivity and the belief that in the new situation (with the offer of a NoiseCall) a complaint would not bring about any change is reflected in the low number of NoiseCall users.

At the same time this is an aspect to optimise in further investigations. It has to be investigated why only few people used the service in order to gain a bigger experimental group. Residents could be asked beforehand, if they would use such service. With a bigger potential user group a randomisation can be achieved, offering the NoiseCall only to a part of the potential users. Through this, person-related interfering variables can be considered.

It has to be taken into consideration that the two groups (users / non-users) were self-selected as their usage behaviour defined the groups. Therefore, person-related interfering variables come into play. In part two of the thesis one interfering aspect has been further investigated: the anger expression.

The results on anger expression of users and non-users are not totally consistent. However, users can be characterised by higher anger expression in general, which is in line with the assumption. The fact that non-users show higher anger-out values during free time indicates that they are not in all domains characterised by less anger-out behaviour. The question is whether a tool like the NoiseCall is appropriate for this group to express anger. It is recommended to examine the personality of users and non-users in more detail to define different possibilities to handle annoyance. Unfortunately, the samples in this study were so small that a differentiated analyse for high/low annoyed users/non-users could not be conducted. This would, however, be the path to follow.

Moreover, it has to be criticised that a social desirability questionnaire has not been used in the study. Especially when investigating the anger expression the knowledge about social desirability would have been beneficial, as anger control for example is socially more accepted than anger expression.

Trust building measures to design and improve the interface of e.g. the system “airport” and “residents” have to match and meet the specific demands of the relationship between these.

The history of the relationship, the current situation, and the future situation (e.g. possible extension) are to be considered to develop an appropriate tool of interfacial design.

Concluding from the study results the NoiseCall seems to be just one possibility (e.g. for small airports with a good relation to its residents) of a preventive measure. Apparently, also due to the different personalities of residents, the design approach should be multi-methodological. An internet platform to lodge a complaint might be more attractive for residents who prefer more anonymity while public meetings might attract those who prefer face-to-face communication.

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Abbreviations

AGB	Augsburg
ATM	Air Traffic Management
AU$	Australian Dollar
BVF	Bundesvereinigung gegen Fluglärm
DAAD	Deutscher Akademischer Austausch Dienst
dB	deci bel
DFA	damage function approach
DIN	Deutsche Industrie Norm
EEG	electroencephalogram
HC	hydrocarbon
HP	hedonic price
HR	Human Resource
Hz	Hertz
ICAO	International Civil Aviation Organisation
ISO	International Organisation for Standardisation
KAS	Kassel
KLM	Koninklijke Luchtvaart Maatschappij; Royal Dutch Airline
Leq	Energy equivalent continuous sound pressure level
Lmax	average maximum noise level
M	Mean
PTS	permanent threshold shift
RP	revealed preference
SD	Standard deviation of the mean

SP	stated preference
STAXI	State-Trait Anger Expression inventory
TTS	temporary threshold shift
w/m^2	watt per square meter
WHO	World Health Organisation
WTP	willingness-to-pay

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Appendix

Fachbereich
Gesellschaftswissenschaften, Philosophie und Theologie (14)
Zusatzstudiengang Organisationspsychologie

Universität Dortmund ı D-44221 Dortmund
FB 14 – Zusatzstudiengang Organisationspsychologie

«NAME»
«STRASSE»

«ORT»

Dr. phil. Joachim Vogt, Dipl.-Psych.

Telefon 0231 / 755 - 4150
Telefax 0231 / 755 - 6501
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http://www.fb14.uni-dortmund.de/~kastner

Datum

Sehr geehrte Dame, sehr geehrter Herr,

mit diesem Schreiben möchten wir Sie um Ihre Teilnahme an einer Untersuchung zur Fluglärmbelastung bitten. Ziel ist es, mögliche Lösungen zu finden für den Interessenkonflikt zwischen dem Flughafen, seiner Arbeitnehmer und Nutzer einerseits und dem Bedürfnis nach Wohnqualität der Anwohner andererseits. Wir als Mitarbeiter der Universität Dortmund untersuchen solche Umweltkonflikte in neutraler Position mit wissenschaftlichen Methoden.

Zu diesem Zweck haben wir dem elektronischen Telefonbuch der Deutschen Telekom Adressen um den Verkehrslandeplatz Kassel-Calden entnommen. Ab dem 10. August würden meine Mitarbeiter Sie gerne anrufen und Sie in einem 20-minütigen Interview bitten, Ihre Betroffenheit durch Fluglärm mitzuteilen. In dem Gespräch möchten wir außerdem fragen, ob Sie Wege zu einer Guten Nachbarschaft sehen. Selbstverständlich werden alle Ihre Angaben anonym erhoben und ausschließlich im Sinne des Datenschutzgesetzes behandelt.

Wenn Sie an einem bestimmten Tag angerufen werden möchten, füllen Sie bitte umseitige Anmeldung aus und senden Sie diese möglichst bis zum **8. August** in beiliegendem, freigestempelten Umschlag zurück.

Für Rückfragen stehen wir Ihnen unter oben genannter Telefonnummer gerne zur Verfügung. Wir würden uns freuen, von Ihnen zu hören, und bedanken uns im voraus für Ihre Kooperationsbereitschaft.

Mit freundlichen Grüßen

Dr. J. Vogt

Anmeldung bitte bis zum 08.08. zurücksenden

Name: __________ **Vorname:** ____________ **Alter:** __________ **Jahre**

Adresse: ____

Telefon-Nr.: ____

Ich möchte an der umseitig beschriebenen Studie teilnehmen (bitte Terminvorschläge vom 10.08. bis 14.09. eintragen):

Folgende Tage/Anfangszeiten kämen für mich in Frage:

Datum: _____________/ **Uhrzeit:** _____________

oder ersatzweise: **Datum:** _____________/ **Uhrzeit:** _____________

Datum: _____________/ **Uhrzeit:** _____________

Datum: _____________/ **Uhrzeit:** _____________

____

Datum, Unterschrift

Code: **EDVK-**

____

Gebiet laut Stichprobenliste: ________________Geschlecht: M W

Guten Tag, mein Name ist ... vom Lehrstuhl für Organisationspsychologie an der Universität Dortmund.
<Falls Telefonpartner noch nicht reagiert hat:>
<Ggf. für Anmeldung zur Teilnahme bedanken>
Ich rufe an wegen der Lärmstudie, haben Sie unser Schreiben bekommen?
<Ggf. erklären, dass wir Wirkungen von Lärm auf den Menschen untersuchen>
<Ggf. Hintergrund der Studie erklären, s. Anschreiben>
Hätten Sie denn jetzt die 20 Minuten Zeit dafür?

Ihr Alter: _______Jahre Ihr Beruf: ___________

Erster Teil: Betroffenheit

Die folgenden Fragen haben sich in der Forschungstradition bewährt, um die Betroffenheit durch Lärm zu erfassen. Bitte antworten Sie spontan und ohne lange nachzudenken:

1. Was stört Sie am meisten (bitte in Rangfolge bringen, Platz 1 größte Störung)

   ____

   ____

2. Wie laut sind die Fluggeräusche im Allgemeinen zu hören?
   nicht (1), wenig (2), mittelmäßig (3), ziemlich (4), sehr (5) laut 1 2 3 4 5

3. Wie belästigend sind die Fluggeräusche im Allgemeinen?
   nicht (1), wenig (2), mittelmäßig (3), ziemlich (4), sehr (5) belästigend 1 2 3 4 5

4. Wie belästigend sind die Fluggeräusche abends und am Wochenende?
   nicht (1), wenig (2), mittelmäßig (3), ziemlich (4), sehr (5) belästigend 1 2 3 4 5

5. Wie lange wohnen Sie schon in dieser Straße? _____Jahre

   Wohnen Sie zur Miete oder gehört Ihnen die Wohnung/das Haus? Miete Eigentum

   Wenn Sie Eigentümer/in sind, wie stark befürchten Sie einen Wertverlust Ihrer Wohnung/ Ihres Hauses durch den Fluglärm?
   Verlust nicht (1), wenig (2), mittelmäßig (3), ziemlich (4), sehr (5) befürchtet 1 2 3 4 5

6. Wenn Sie einmal an die letzten 12 Monate bei Ihnen denken, wie stark haben Sie sich, alles in allem genommen durch Lärm (vom Flughafen) gestört oder belästigt gefühlt? War es
überhaupt nicht (1), etwas (2), mittelmäßig (3), stark (4), äußerst (5) 1 2 3 4 5
(Skala des International Committee on Biological Effects of Noise Team 6)

7. Wie oft fliegen Sie selbst pro Jahr? ___mal/Jahr

	Kassel	Paderb.	Sonstige
beruflich			
privat			

8. Für wie gesundheitsschädigend halten Sie Lärm?
nicht (1), wenig (2), mittelmäßig (3), ziemlich (4), sehr (5) ges.schädlich 1 2 3 4 5

Wie sind Sie mit Ihrem Gesundheitszustand zufrieden?
nicht (1), wenig (2), mittelmäßig (3), ziemlich (4), sehr (5) zufrieden 1 2 3 4 5

9. Für wie geräuschempfindlich - ganz allgemein, gegen Geräusche aller Art - halten Sie sich?
nicht (1), wenig (2), mittelmäßig (3), ziemlich (4), sehr (5) empfindlich 1 2 3 4 5

10. Wie belästigend sind die Fluggeräusche im Allgemeinen? <Kastka-Skala>
(nicht 1, sehr schwach 2, schwach 3, deutlich 4, stark 5, sehr stark 6, unerträglich 7)
1 2 3 4 5 6 7

Zweiter Teil: Gute Nachbarschaft

11. Wie würden Sie die Beziehung - so wie sie jetzt ist - zwischen dem Flughafen und seinen Anwohnern beschreiben?

____

____

Welches Gefühl bestimmt Ihre Einstellung zum Flughafen?

Leitemotion:______________________________

12. Wie zufrieden sind Sie mit der Art, wie mit der Lärmproblematik umgegangen wird? nicht (1), wenig (2), mittelmäßig (3), ziemlich (4), sehr (5) zufrieden
Seitens der Flughafen GmbH 1 2 3 4 5
Seitens der Politiker 1 2 3 4 5

13. Wie stellen Sie sich eine „gute Nachbarschaft" zwischen Flughafen und Anwohnern vor?

____

____

14. Was könnte die Flughafen GmbH tun, um diese gute Nachbarschaft zu erreichen und zu erhalten?

15. Könnten Sie sich vorstellen, als Anwohner an der guten Nachbarschaft mitzuwirken? Wenn ja, wie?

16. Für wie wahrscheinlich halten Sie es, dass wir als Wissenschaftler und unabhängige Vermittler zur Lösung beitragen können?
nicht (1), wenig (2), mittelmäßig (3), ziemlich (4), sehr (5) wahrscheinlich
1 2 3 4 5

17. Im September 2001 möchten wir ein Lärmtelefon einrichten. Wie häufig würden Sie dieses nutzen?
nie (1), selten (2), manchmal (3), oft (4), dauernd (5) nutzen 1 2 3 4 5

18. Angenommen, die Flughafen GmbH Kassel möchte die Nachbarschaft verbessern und setzt Maßnahmen wie das Lärmtelefon ein. Ihre Hinweise würden ernsthaft auf mögliche Gegenmaßnahmen hin überprüft. Könnte das Ihre Einstellung zum Flughafen beeinflussen?
nicht (1), wenig (2), mittelmäßig (3), ziemlich (4), sehr (5) 1 2 3 4 5

19. Wir möchten diese Befragung im Herbst und evtl. im Frühjahr wiederholen. Würden Sie dabei mitmachen? nein ja

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Datum

Sehr geehrte Dame, sehr geehrter Herr,
sicherlich erinnern Sie sich daran, dass wir Sie vor einigen Wochen angeschrieben haben, um die Lärmproblematik am Verkehrslandeplatz Kassel-Calden zu untersuchen. Vielen Dank, dass Sie diesem Aufruf gefolgt sind und uns bereits ein Interview gegeben haben. Inzwischen hat der Verein zur Förderung des Umwelt-, Gesundheits- und Sicherheitsverhaltens FUGS e.V. Lünen in Zusammenarbeit mit der Universität Dortmund ein Lärmtelefon eingerichtet.
Ab sofort bis zum 27. Oktober 2001 bieten Ihnen meine Mitarbeiterinnen und Mitarbeiter rund um die Uhr einen kostenlosen Service: Unter der für Sie **gebührenfreien Telefonnummer 0800-5276783** (entspricht den Buchstaben „Lärmruf“ auf den meisten Telefontastaturen) können Sie jederzeit anrufen, wenn Sie sich durch den Verkehrslandeplatz, insbes. durch Lärm, gestört fühlen. Meine Mitarbeiterinnen und Mitarbeiter werden Ihre Beschwerden und/oder Anregungen gerne entgegennehmen. Soweit möglich werden Ihnen auch Fragen beantwortet.
Diesem Schreiben liegt ein **Aufkleber** bei, den Sie bitte auf oder in der Nähe Ihres Telefons anbringen. Darauf finden Sie zunächst die Nummer des Lärmtelefons und darunter eine Antwortskala, die im Laufe des Telefoninterviews Verwendung finden wird: Die Belästigung durch den Lärm wie auch Ihre Einschätzung der Nützlichkeit des Lärmtelefons geben Sie bitte mit 1: nicht, 2: wenig, 3: mittelmäßig, 4: ziemlich, 5: sehr belästigend bzw. nützlich an.
Außerdem nennen Sie bitte bei jedem Anruf die Buchstaben-Zahlen-Kombination **T-«Telzusatz»**, welche der Anonymisierung Ihres Anrufes dient. Selbstverständlich werden alle Ihre Angaben anonym erhoben und ausschließlich im Sinne des Datenschutzgesetzes behandelt. Auch eine Identifizierung über die ISDN-Teilnehmeranzeige werden wir ausschließen.
Bitte haben Sie Verständnis dafür, dass wir Ihren Anruf teilweise in standardisierter Form entgegennehmen müssen, um die Daten zu Forschungszwecken verwenden zu können. Aus dem gleichen Grunde ist es wichtig, dass immer die Person aus Ihrem Haushalt anruft, die bereits an der Befragung teilgenommen hat.
Meine Mitarbeiter/innen und ich hoffen sehr, dass Sie das Lärmtelefon in Anspruch nehmen. Damit nutzen Sie nicht nur die Gelegenheit, sich zu äußern, sondern Sie arbeiten aktiv an der Gestaltung der guten Nachbarschaft mit, die wir in Zusammenarbeit mit allen Beteiligten erreichen möchten. Im Rahmen einer Langzeitstudie - wenn weitere Forschungsgelder bewilligt werden - möchten wir die Studie und das Lärmtelefon wiederholt anbieten.
Für Rückfragen stehen wir Ihnen auch unter der Telefonnummer 0231-7554150 gerne zur Verfügung. Wir würden uns freuen, von Ihnen zu hören, und bedanken uns im Voraus für Ihre Kooperationsbereitschaft.
Mit freundlichen Grüßen
Dr. J. Vogt

Lärmruf der Universität Dortmund, mein Name ist...

Code: T-____________(Kassel)

Straße, Nr.: ______________________ Ort: ______________

Geschlecht: ______________________ **Alter:** ______________

Datum: ________ **Uhrzeit:** ____________

Interviewleitfaden zur Aufnahme von Beschwerden in den Flugzonen

1. Beschwerdeanlass:
Warum rufen Sie an?

____

____

2. Wann genau fand dieses Ereignis statt?

Datum: ________________ genaue Uhrzeit: _________________

3. Bitte beschreiben Sie das Luftfahrzeug so genau wie möglich.

____

____

Flugrichtung: _______________ geschätzte Höhe:

4. Fühlten Sie sich durch das Ereignis bei einer Tätigkeit gestört? Wenn ja, bei welcher?

Tätigkeit:
____

Wie stark fühlten Sie sich gestört?
nicht (1), wenig (2), mittelmäßig (3), ziemlich (4), sehr (5) 1 2 3 4 5

5. Fühlten Sie sich durch das Ereignis belästigt? Wenn ja, wie sehr?
nicht (1), wenig (2), mittelmäßig (3), ziemlich (4), sehr (5) 1 2 3 4 5

6. Wir möchten mit einer statistischen Auswertung der Anrufe an den Flughafen herantreten. Was stellen Sie sich als angemessene Reaktion des Flughafens vor?

____

7. Könnte sich dadurch Ihre Einstellung zum Flughafen verändern und eine „Gute Nachbarschaft“ näher rücken?
nicht (1), wenig (2), mittelmäßig (3), ziemlich (4), sehr (5) 1 2 3 4 5

8. Finden Sie dieses Lärmtelefon nützlich?
nicht (1), wenig (2), mittelmäßig (3), ziemlich (4), sehr (5) 1 2 3 4 5

Falls „nicht“ bis „mittel“:

9. **Was hätten wir Ihrer Meinung nach besser machen sollen? Was hätten Sie sich gewünscht?**

---

10. **(Nur wenn Anliegen nicht sofort bearbeitet werden kann): Wann sind Sie am besten zu erreichen, damit ihre Frage beantwortet werden kann bzw. damit zu Ihrer Beschwerde Stellung bezogen werden kann?**

Tel.-Nr.: ______________________________ **Uhrzeit:** ________________

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX XXX

11. **(Nach Bearbeitung der Beschwerde): Waren Sie mit unserer Leistung zufrieden? Konnten wir Ihnen weiterhelfen? Wenn ja, wie sehr?**
    nicht (1), wenig (2), mittelmäßig (3), ziemlich (4), sehr (5) 1 2 3 4 5

Falls „nicht“ bis „mittel“:

12. **Was hätten wir Ihrer Meinung nach besser machen sollen? Was hätten Sie sich gewünscht?**

Festellungen:

Luftfahrtunternehmen: ____

Luftfahrzeug: ________________________________ Flug-Nr.: ______________

Start ☐
Landung ☐
Uhrzeit: ___________
Richtung: __________
Anlaß (Trainingsflug, Meßflüge, etc.): ___________________________________
Metereologische Daten:

____

____

____

Maßnahmen:

Mitteilung an: ____
Information benötigt von: ____
Luftfahrtunternehmen: ____

Ergebnis:

____

____

____

____

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http://www.fb14.uni-dortmund.de/~kastner

Datum 12.01.2006

Sehr geehrte Dame, sehr geehrter Herr,

sicherlich erinnern Sie sich daran, dass wir Sie im Rahmen einer Untersuchung zur Lärmproblematik am Verkehrslandeplatz Kassel-Calden im Sommer schon einmal angeschrieben haben. Bislang konnten wir eine erste Befragung durchführen, die die derzeitige Belästigung der Anwohner und ihre Wünsche in Bezug auf den Verkehrslandeplatz erfasst hat. In der Zeit vom 27. August bis zum 27. Oktober wurde den Anwohner die Möglichkeit gegeben, den kostenlosen Service eines Lärmtelefons zu nutzen. Das Lärmtelefon wurde eingerichtet vom Verein zur Förderung des Umwelt-, Gesundheits- und Sicherheitsverhaltens FUGS e.V. Lünen in Zusammenarbeit mit der Universität Dortmund. Die Anwohner konnten jederzeit anrufen, wenn sie sich durch den Verkehrslandeplatz, insbes. durch Lärm, gestört fühlten. Meine Mitarbeiterinnen und Mitarbeiter haben die Beschwerden und/oder Anregungen entgegengenommen und ggf. Fragen beantwortet. Falls Sie an unserer ersten Befragung teilgenommen und/oder das Lärmtelefon genutzt haben, möchten wir uns schon einmal herzlich bedanken.

Wir würden nun gerne von Ihnen wissen, aus welchen Gründen Sie das Angebot des Lärmtelefons genutzt oder nicht genutzt haben. Dazu möchten meine Mitarbeiter/innen Sie telefonisch befragen. In diesem Gespräch möchten wir erfahren, ob das Lärmtelefon für Sie als Anwohner hilfreich war bzw. was wir verbessern können und was Sie sich für die Zukunft wünschen würden. Sie haben die Möglichkeit, einen Terminvorschlag für unseren Anruf auf der Rückseite dieses Schreibens anzugeben und kostenlos an die Universität Dortmund zu schicken. Wir werden Sie dann zum angegebenen Zeitpunkt anrufen. Das Telefonat wird voraussichtlich 20 Minuten dauern. Ihre Teilnahme ist sehr wichtig und bietet Ihnen die Möglichkeit, aktiv an der Gestaltung Ihrer Nachbarschaft zum Verkehrslandeplatz teilzunehmen.

Für Rückfragen stehen wir Ihnen auch unter der Telefonnummer 0231-7554150 gerne zur Verfügung. Wir würden uns freuen, von Ihnen zu hören, und bedanken uns im Voraus für Ihre Kooperationsbereitschaft.

Mit freundlichen Grüßen
Dr. J. Vogt

Anmeldung bitte bis zum 09.11. zurücksenden

Name: __________ **Vorname:** ____________ **Alter:** __________ **Jahre**

Adresse: ____

Telefon-Nr.: ____

Ich möchte an der umseitig beschriebenen Studie teilnehmen (bitte Terminvorschläge vom 12.11. bis 30.11. eintragen):

Folgende Tage/Anfangszeiten kämen für mich in Frage:

Datum: _____________/ **Uhrzeit:** _____________

oder ersatzweise: **Datum:** _____________/ **Uhrzeit:** _____________

Datum: _____________/ **Uhrzeit:** _____________

Datum: _____________/ **Uhrzeit:** _____________

____
Datum, Unterschrift

Code: EDVK-

____

Gebiet laut Stichprobenliste: ________________Geschlecht: M W

Guten Tag, mein Name ist ... vom Lehrstuhl für Organisationspsychologie an der Universität Dortmund.
<Falls Telefonpartner noch nicht reagiert hat:>
<Ggf. für Anmeldung zur Teilnahme bedanken>
Ich rufe an wegen der Lärmstudie, haben Sie unser Schreiben bekommen?
<Ggf. erklären, dass wir Wirkungen von Lärm auf den Menschen untersuchen>
<Ggf. Hintergrund der Studie erklären, s. Anschreiben>
Hätten Sie denn jetzt die 20 Minuten Zeit dafür?

Ihr Alter: _______Jahre Ihr Beruf: ____________

Erster Teil: Betroffenheit

Die folgenden Fragen haben sich in der Forschungstradition bewährt, um die Betroffenheit durch Lärm zu erfassen. Bitte antworten Sie spontan und ohne lange nachzudenken:

8. Was stört Sie am meisten (bitte in Rangfolge bringen, Platz 1 größte Störung)

   ____

9. Wie laut sind die Fluggeräusche im Allgemeinen zu hören?
   nicht (1), wenig (2), mittelmäßig (3), ziemlich (4), sehr (5) laut 1 2 3 4 5

10. Wie belästigend sind die Fluggeräusche im Allgemeinen?
    nicht (1), wenig (2), mittelmäßig (3), ziemlich (4), sehr (5) belästigend
    1 2 3 4 5

11. Wie belästigend sind die Fluggeräusche abends und am Wochenende?
    nicht (1), wenig (2), mittelmäßig (3), ziemlich (4), sehr (5) belästigend
    1 2 3 4 5

12. Wie lange wohnen Sie schon in dieser Straße? _____Jahre

    Wohnen Sie zur Miete oder gehört Ihnen die Wohnung/das Haus?
    Miete Eigentum

13. Wenn Sie Eigentümer/in sind, wie stark befürchten Sie einen Wertverlust Ihrer Wohnung/ Ihres Hauses durch den Fluglärm?
    Verlust nicht (1), wenig (2), mittelmäßig (3), ziemlich (4), sehr (5) befürchtet
    1 2 3 4 5

14. Wenn Sie einmal an die letzten 12 Monate bei Ihnen denken, wie stark haben Sie sich, alles in allem genommen durch Lärm (vom Flughafen) gestört oder belästigt gefühlt? War es
überhaupt nicht (1), etwas (2), mittelmäßig (3), stark (4), äußerst (5) 1 2 3 4 5
(Skala des International Committee on Biological Effects of Noise Team 6)

15. Wie oft fliegen Sie selbst pro Jahr? ___mal/Jahr

	Kassel	Paderb.	Sonstige
beruflich			
privat			

16. Für wie gesundheitsschädigend halten Sie Lärm?
nicht (1), wenig (2), mittelmäßig (3), ziemlich (4), sehr (5) ges.schädlich
1 2 3 4 5

17. Wie sind Sie mit Ihrem Gesundheitszustand zufrieden?
nicht (1), wenig (2), mittelmäßig (3), ziemlich (4), sehr (5) zufrieden 1 2 3 4 5

18. Für wie geräuschempfindlich - ganz allgemein, gegen Geräusche aller Art - halten Sie sich?
nicht (1), wenig (2), mittelmäßig (3), ziemlich (4), sehr (5) empfindlich
1 2 3 4 5

19. Wie belästigend sind die Fluggeräusche im Allgemeinen? <Kastka-Skala>
(nicht 1, sehr schwach 2, schwach 3, deutlich 4, stark 5, sehr stark 6, unerträglich 7)
1 2 3 4 5 6 7

Zweiter Teil: Gute Nachbarschaft

20. Wie würden Sie die Beziehung - so wie sie jetzt ist - zwischen dem Flughafen und seinen Anwohnern beschreiben?

____

____

Welches Gefühl bestimmt Ihre Einstellung zum Flughafen?

Leitemotion:______________________________

21. Wie zufrieden sind Sie mit der Art, wie mit der Lärmproblematik umgegangen wird? nicht (1), wenig (2), mittelmäßig (3), ziemlich (4), sehr (5) zufrieden
Seitens der Flughafen GmbH 1 2 3 4 5
Seitens der Politiker 1 2 3 4 5

22. Wie stellen Sie sich eine „gute Nachbarschaft“ zwischen Flughafen und Anwohnern vor?

____

____

23. Was könnte die Flughafen GmbH tun, um diese gute Nachbarschaft zu erreichen und zu erhalten?

____

24. Könnten Sie sich vorstellen, als Anwohner an der guten Nachbarschaft mitzuwirken? Wenn ja, wie?

____

25. Für wie wahrscheinlich halten Sie es, dass wir als Wissenschaftler und unabhängige Vermittler zur Lösung beitragen können?
nicht (1), wenig (2), mittelmäßig (3), ziemlich (4), sehr (5) wahrscheinlich
1 2 3 4 5

26. Im Sommer 2001 hatten wir ein Lärmtelefon für den Flughafen eingerichtet. Haben Sie es benutzt? nein ja
Wenn ja, warum und hat es Ihnen genutzt?

____

nicht (1), wenig (2), mittelmäßig (3), ziemlich (4), sehr (5) genutzt
1 2 3 4 5

Wenn nein, warum nicht, was sollten wir anders machen?

27. Angenommen, die Flughafen GmbH Kassel möchte die Nachbarschaft verbessern und setzt Maßnahmen wie das Lärmtelefon ein. Ihre Hinweise würden ernsthaft auf mögliche Gegenmaßnahmen hin überprüft. Könnte das Ihre Einstellung zum Flughafen beeinflussen?
nicht (1), wenig (2), mittelmäßig (3), ziemlich (4), sehr (5) 1 2 3 4 5

Die Ausbaupläne der Flughafen GmbH werden entweder Gebiete der Stadt Kassel oder solche des Landkreises stärker betreffen. Wie ist Ihre Meinung zur Variante über Kasseler Stadtgebiet? habe keine Meinung (1), lehne strikt ab (2), finde schlecht (3), finde gut (4), begrüße sehr (5) 1 2 3
4 5

28. Wie ist Ihre Meinung zur Variante über Landkreisgebiet?
habe keine Meinung (1), lehne strikt ab (2), finde schlecht (3), finde gut (4), begrüße sehr (5) 1 2
3 4 5

29. Wie stark befürworten Sie den Ausbau?
nicht (1), wenig (2), mittelmäßig (3), ziemlich (4), sehr (5) 1 2 3 4 5
Wenn Sie den Ausbau nicht, wenig oder mittel befürworten, könnten Auflagen (z. B. Ruhezeiten) Ihre Einstellung in Richtung ziemlich/sehr verändern? nein ja
Wenn ja, welche?

____

30. Wir möchten diese Befragung und auch den Lärmruf evtl. im Frühjahr/Sommer wiederholen. Würden Sie dabei mitmachen?

Befragung	nein	ja
Lärmruf	nein	ja

Outline for the noise line operators at Airservices Australia

Firstly, we would like to thank you for your support in conducting this study on "Individual Differences in Complaint Behaviour", which aims to investigate features of repeated complainers vs. single/non-complainers. We would like to interview residents calling your noise line with respect to their personality, anger expression, and health status and compare the findings with residents who called just once or did not call your noise line at all (to be recruited by personal approach). For background information on the study please refer to the outline attached to this document. You are welcome to get in contact with us personally discussing any further questions (maren.maziul@web.de or 0410255516).

You can help by informing all residents calling your noise line about the study and invite them to participate. If the residents are interested please ask them for their **phone number**. This is the data we **necessarily** need, because the study will be conducted using telephone interviews. The *time of day* they prefer to be called would be helpful to us, as well as the *name* and *address*.

Please use the following introduction to invite the callers to participate. It is important that all potential participants get the same information.

I would like to invite you to participate in a study being conducted by the Universities of Sydney and Dortmund (Germany), which aims to help us to manage noise better and help people to cope with noise.
If you agree to participate in this study and provide your telephone number, the researchers will call you to interview you. The interview consists of questions about the noise you experience, how it affects you and about how you respond to stress. The interview takes approximately 45 minutes.
All aspects of the study, including results, will be strictly confidential and results will only be reported as grouped data so individuals cannot be identified. Participation in this study is entirely voluntary and if you choose to participate, you can withdraw at any time.

You are welcome to get further information on the study by either leaving your phone number or contacting the investigators yourself (maren.maziul@web.de).

  - o Would you like to participate?
- *If yes:*
  - o May I have your phone number?
  - o It will help us to contact you if you leave us your name and address. Is that ok? So what is your name and address?
  - o Is there a good time for the investigators to call? When?
- *If "no" to participate:*
  - o Would you like more information about the study?
    - § Can we contact you? (see above)
    - § Would you like to contact the investigators? **à** Provide details.

Thank you very much for your time already."

Dr. Julie Hatfield Maren Maziul

Dear resident,

in the context of our research we deal with the effects of aircraft noise. To know more about annoyance you as a resident might suffer from due to aircraft noise, we are conducting a study for the Universities of Sydney and Dortmund to investigate residents' experience of aircraft noise and their needs for coping with it. You can help us by completing a short questionnaire on noise related questions as well as questions about how you deal with anger.
Results of this study can be downloaded on the University homepage: www.orgapsy.uni-dortmund.de/sydney.

We thank you very much for your participation in the study and for taking the time to fill in the questionnaire!!

If you have any complain or question concerning any aspect of this research, you may contact the Human Ethics Officer at the University of Sydney.

The researches hereby assure that participation is voluntary and you as participant are permitted to withdraw from the project at any time. All of your responses are anonymous and confidential.

I hereby declare that I voluntarily took part in the study "Complaint behaviour" conducted by the Universities of Sydney and Dortmund.

____________ ____________

Date Name

For any further questions concerning this study, please contact Maren Maziul:
Email: maziul@orgapsy.uni-dortmund.de
Phone: 99399803

Instructions

This questionnaire is divided into six parts. Please note that each part has ***different*** directions. Carefully read the directions for each part before recording your responses.

There are **no right or wrong answers** in the questionnaire. Please answer the questions according to your personal feelings.

1. Code:

2. Suburb:

3. Postcode:

4. Sex: Female ☐ ☐

5. Age group:
   1. 18-29
   2. 30-39
   3. 40-49
   4. 50-59
   5. 60-69
   6. over 70 years
   7. refused

6. What is the highest level of education you have completed?
   1. 1-3 yrs Primary
   2. 4-6 yrs Primary
   3. 1-4 yrs Secondary
   4. 5-6 yrs Secondary
   5. 1-2 yrs Tertiary
   6. 3+ Tertiary
   7. refused

7. Occupation: ________________

    1. Home duties
    2. Professional / managerial
    3. White collar
    4. Blue collar
    5. Retired
    6. Unemployed
    7. Student

8. Please indicate which language is spoken **at home**: ______________________

9. What is your marital status?

    1. single
    2. married
    3. divorced
    4. widowed
    5. other

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1. How many years have you been living at this address?
   Years:

2. Do you or your family own this house (unit) or do you rent it? ☐ ☐
    1. Own
    2. Rent

    a. If you are the owner: Do you fear financial losses because of the aircraft noise?
       Not at all (1), a little (2), moderately (3), quite a bit (4), extremely (5) 1 2 3 4 5

3. How loud are the aircraft noises in general?
   Not at all (1), a little (2), moderately (3), quite a bit (4), extremely (5) 1 2 3 4 5

4. How annoying do you find the aircraft noises in general?
   Not at all (1), a little (2), moderately (3), quite a bit (4), extremely (5) 1 2 3 4 5

5. Thinking about the last 12 months or so, when you are at home, how much does noise from aircrafts bother, disturb, or annoy you: extremely, very, moderately, slightly, or not at all?

   not at all 0---1---2---3---4---5---6---7---8---9---10 extremely

   (Scale of the International Committee on Biological Effects of Noise Team 6)

6. What do you normally do to control aircraft noise?

a. Close the windows and doors
b. Use air-conditioning
c. Turn up the volume on the television, radio, or stereo
d. Use head phones
e. Move to a quieter room
f. Other

7. Have you ever made a complaint or protest about aircraft noise?

    1. Yes
    2. No
    3. Don't know

8. How sensitive would you say you are to noise in general (noise of all sources)?
   Not at all (1), a little (2), moderately (3), quite a bit (4), extremely (5) 1 2 3 4 5

9. How hazardous do you belief noise to be?
   Not at all (1), a little (2), moderately (3), quite a bit (4), extremely (5) 1 2 3 4 5

10. How much do you feel afraid or worried about a possible plane crash in this neighbourhood?
    Not at all (1), a little (2), moderately (3), quite a bit (4), extremely (5) 1 2 3 4 5

11. How content are you with your health status?
    Not at all (1), a little (2), moderately (3), quite a bit (4), extremely (5) 1 2 3 4 5

12. Have you ever had (or do you have)…
    a. high blood pressure
        1. Yes
        2. No
    b. a heart attack?
        1. Yes
        2. No
    c. cancer?
        1. Yes
        2. No

Directions: A number of statements that people use to describe themselves are given below. Read each statement and then mark (circle or cross) your answer on the sheet which indicates how you ***generally*** feel. Remember that there are no right or wrong answers. Do not spend too much time on any one statement, but give the answer which seems to *best* describe how you ***generally*** feel.
NOTE: The numbers of the items of this scale are **1 -10.**

How I Generally Feel	Almost Never	Some-times	Often	Almost Always
1. I am quick tempered.	1	2	3	4
2. I have a fiery temper.	1	2	3	4
3. I am a hot-headed person.	1	2	3	4
4. I get angry when I'm slowed down by others' mistakes.	1	2	3	4
5. I feel annoyed when I am not given recognition for doing good work.	1	2	3	4
6. I fly of the handle.	1	2	3	4
7. When I get mad, I say nasty things.	1	2	3	4
8. It makes me furious when I am criticized in front of others.	1	2	3	4
9. When I get frustrated, I feel like hitting someone.	1	2	3	4
10. I feel infuriated when I do a good job and get a poor evaluation.	1	2	3	4

Directions: Everyone feels angry or furious from time to time, but people differ in the ways that they react when they are angry. A number of statements are listed below which people use to describe their reactions when they feel ***angry* or *furious***. Read each statement and then fill in the number on your answer sheet which indicates how ***often*** you ***generally*** react or behave in the manner described when you are feeling angry or furious. Remember, that there are no right or wrong answers. Do not spend too much time on any one statement.

NOTE: The numbers of the items of this scale are **11 -34.**

	When Angry or Furious ...	Almost Never	Some-times	Often	Almost Always
11.	I control my temper.	1	2	3	4
12.	I express my anger.	1	2	3	4
13.	I keep things in.	1	2	3	4
14.	I am patient with others.	1	2	3	4
15.	I pout or sulk.	1	2	3	4
16.	I withdraw from people.	1	2	3	4
17.	I make sarcastic remarks to others.	1	2	3	4
18.	I keep my cool.	1	2	3	4
19.	I do things like slam doors.	1	2	3	4
20.	I boil inside, but I don't show it.	1	2	3	4
21.	I control my behaviour.	1	2	3	4
22.	I argue with others.	1	2	3	4
23.	I tend to harbour grudges that I don't tell anyone about.	1	2	3	4
24.	I strike out at whatever infuriates me.	1	2	3	4
25.	I can stop myself from losing my temper.	1	2	3	4
26.	I am secretly quite critical of others.	1	2	3	4
27.	I am angrier than I am willing to admit.	1	2	3	4
28.	I calm down faster than most other people.	1	2	3	4
29.	I say nasty things.	1	2	3	4
30.	I try to be tolerant and understanding.	1	2	3	4
31.	I'm irritated a great deal more than people are aware of.	1	2	3	4
32.	I lose my temper.	1	2	3	4
33.	If someone annoys me, I'm apt to tell him or her how I feel.	1	2	3	4
34.	I control my angry feelings.	1	2	3	4

<u>Directions</u>: Everyone feels angry or furious from time to time, but people differ in the ways that they react when they are angry. A number of statements are listed below which people use to describe their reactions when they feel ***angry* or *furious***. Read each statement and then circle the number which indicates how *often* you react or behave in the manner described when you are feeling angry or furious ***at home***. Remember that there are no right or wrong answers. Do not spend too much time on any one statement.

NOTE: The numbers of the items of this scale are **41 -64.**

	When Angry or Furious at Home...	Almost Never	Some-times	Often	Almost Always
41.	I control my temper.	1	2	3	4
42.	I express my anger.	1	2	3	4
43.	I keep things in.	1	2	3	4
44.	I am patient with others.	1	2	3	4
45.	I pout or sulk.	1	2	3	4
46.	I withdraw from people.	1	2	3	4
47.	I make sarcastic remarks to others.	1	2	3	4
48.	I keep my cool.	1	2	3	4
49.	I do things like slam doors.	1	2	3	4
50.	I boil inside, but I don't show it.	1	2	3	4
51.	I control my behaviour.	1	2	3	4
52.	I argue with others.	1	2	3	4
53.	I tend to harbour grudges that I don't tell anyone about.	1	2	3	4
54.	I strike out at whatever infuriates me.	1	2	3	4
55.	I can stop myself from losing my temper.	1	2	3	4
56.	I am secretly quite critical of others.	1	2	3	4
57.	I am angrier than I am willing to admit.	1	2	3	4
58.	I calm down faster than most other people.	1	2	3	4
59.	I say nasty things.	1	2	3	4
60.	I try to be tolerant and understanding.	1	2	3	4
61.	I'm irritated a great deal more than people are aware of.	1	2	3	4
62.	I lose my temper.	1	2	3	4
63.	If someone annoys me, I'm apt to tell him or her how I feel.	1	2	3	4
64.	I control my angry feelings.	1	2	3	4

Directions: Everyone feels angry or furious from time to time, but people differ in the ways that they react when they are angry. A number of statements are listed below which people use to describe their reactions when they feel ***angry* or *furious***. Read each statement and then fill in the number on your answer sheet which indicates how often you react or behave in the manner described when you are feeling angry or furious ***at work or school***. Remember that there are no right or wrong answers. Do not spend too much time on any one statement.
NOTE: The numbers of the items of this scale are **71 -94.**

	When Angry or Furious at Work...	Almost Never	Some-times	Often	Almost Always
71.	I control my temper.	1	2	3	4
72.	I express my anger.	1	2	3	4
73.	I keep things in.	1	2	3	4
74.	I am patient with others.	1	2	3	4
75.	I pout or sulk.	1	2	3	4
76.	I withdraw from people.	1	2	3	4
77.	I make sarcastic remarks to others.	1	2	3	4
78.	I keep my cool.	1	2	3	4
79.	I do things like slam doors.	1	2	3	4
80.	I boil inside, but I don't show it.	1	2	3	4
81.	I control my behaviour.	1	2	3	4
82.	I argue with others.	1	2	3	4
83.	I tend to harbour grudges that I don't tell anyone about.	1	2	3	4
84.	I strike out at whatever infuriates me.	1	2	3	4
85.	I can stop myself from losing my temper.	1	2	3	4
86.	I am secretly quite critical of others.	1	2	3	4
87.	I am angrier than I am willing to admit.	1	2	3	4
88.	I calm down faster than most other people.	1	2	3	4
89.	I say nasty things.	1	2	3	4
90.	I try to be tolerant and understanding.	1	2	3	4
91.	I'm irritated a great deal more than people are aware of.	1	2	3	4
92.	I lose my temper.	1	2	3	4
93.	If someone annoys me, I'm apt to tell him or her how I feel.	1	2	3	4
94.	I control my angry feelings.	1	2	3	4

Directions: Everyone feels angry or furious from time to time, but people differ in the ways that they react when they are angry. A number of statements are listed below which people use to describe their reactions when they feel ***angry* or *furious***. Read each statement and then fill in the number on your answer sheet which indicates how often you react or behave in the manner described when you are feeling angry or furious ***during your free time away from home and work***. Remember that there are no right or wrong answers. Do not spend too much time on any one statement.

NOTE: The numbers of the items of this scale are **101 -124**

	When Angry or Furious During Free Time...	Almost Never	Some-times	Often	Almost Always
101.	I control my temper.	1	2	3	4
102.	I express my anger.	1	2	3	4
103.	I keep things in.	1	2	3	4
104.	I am patient with others.	1	2	3	4
105.	I pout or sulk.	1	2	3	4
106.	I withdraw from people.	1	2	3	4
107.	I make sarcastic remarks to others.	1	2	3	4
108.	I keep my cool.	1	2	3	4
109.	I do things like slam doors.	1	2	3	4
110.	I boil inside, but I don't show it.	1	2	3	4
111.	I control my behaviour.	1	2	3	4
112.	I argue with others.	1	2	3	4
113.	I tend to harbour grudges that I don't tell anyone about.	1	2	3	4
114.	I strike out at whatever infuriates me.	1	2	3	4
115.	I can stop myself from losing my temper.	1	2	3	4
116.	I am secretly quite critical of others.	1	2	3	4
117.	I am angrier than I am willing to admit.	1	2	3	4
118.	I calm down faster than most other people.	1	2	3	4
119.	I say nasty things.	1	2	3	4
120.	I try to be tolerant and understanding.	1	2	3	4
121.	I'm irritated a great deal more than people are aware of.	1	2	3	4
122.	I lose my temper.	1	2	3	4
123.	If someone annoys me, I'm apt to tell him or her how I feel.	1	2	3	4
124.	I control my angry feelings.	1	2	3	4

Correlation matrix of the predictor variables

Korrelationen

		Lärmbelastung dB (A)	Halten Sie lärm für gesundheitsschädigend	Zufriedenheit mit Gesundheitszustand	Geräuschempfindlichkeit allgemein	Wie lange wohnen Sie schon in dieser Straße	Wie laut sind die Fluggeräusche im Allgemeinen zu hören?	Zufriedenheit im Umgang mit der Lärmproblematik :Augsburger Flughafen GmbH	Zufriedenheit im Umgang mit der Lärmproblematik: Politiker	Befürchtung des Wertverlustes des Hauses/der Wohnung
Lärmbelastung dB (A)	Korrelation nach Pearson	1	-,027	-,103	,012	,053	,362**	-,133	-,134	,372**
	Signifikanz (2-seitig)		,676	,112	,858	,409	,000	,070	,066	,000
	N	245	236	238	238	244	237	186	189	194
Halten Sie lärm für gesundheitsschädigend	Korrelation nach Pearson	-,027	1	-,074	,329**	-,125*	,271**	-,398**	-,242**	,434**
	Signifikanz (2-seitig)	,676		,175	,000	,022	,000	,000	,000	,000
	N	236	339	337	338	338	337	268	269	265
Zufriedenheit mit Gesundheitszustand	Korrelation nach Pearson	-,103	-,074	1	-,046	-,027	-,137*	,159**	,169**	-,207**
	Signifikanz (2-seitig)	,112	,175		,394	,619	,012	,009	,005	,001
	N	238	337	341	340	340	339	270	271	267
Geräuschempfindlichkeit allgemein	Korrelation nach Pearson	,012	,329**	-,046	1	,047	,087	-,116	-,030	,138*
	Signifikanz (2-seitig)	,858	,000	,394		,390	,110	,057	,627	,024
	N	238	338	340	342	341	340	270	271	267
Wie lange wohnen Sie schon in dieser Straße	Korrelation nach Pearson	,053	-,125*	-,027	,047	1	,039	,099	,110	-,144*
	Signifikanz (2-seitig)	,409	,022	,619	,390		,478	,103	,070	,019
	N	244	338	340	341	350	340	271	272	268
Wie laut sind die Fluggeräusche im Allgemeinen zu hören?	Korrelation nach Pearson	,362**	,271**	-,137*	,087	,039	1	-,449**	-,315**	,521**
	Signifikanz (2-seitig)	,000	,000	,012	,110	,478		,000	,000	,000
	N	237	337	339	340	340	341	270	271	266
Zufriedenheit im Umgang mit der Lärmproblematik :Augsburger Flughafen GmbH	Korrelation nach Pearson	-,133	-,398**	,159**	-,116	,099	-,449**	1	,597**	-,545**
	Signifikanz (2-seitig)	,070	,000	,009	,057	,103	,000		,000	,000
	N	186	268	270	270	271	270	271	258	220
Zufriedenheit im Umgang mit der Lärmproblematik: Politiker	Korrelation nach Pearson	-,134	-,242**	,169**	-,030	,110	-,315**	,597**	1	-,493**
	Signifikanz (2-seitig)	,066	,000	,005	,627	,070	,000	,000		,000
	N	189	269	271	271	272	271	258	272	222
Befürchtung des Wertverlustes des Hauses/der Wohnung	Korrelation nach Pearson	,372**	,434**	-,207**	,138*	-,144*	,521**	-,545**	-,493**	1
	Signifikanz (2-seitig)	,000	,000	,001	,024	,019	,000	,000	,000	
	N	194	265	267	267	268	266	220	222	268

**. Die Korrelation ist auf dem Niveau von 0,01 (2-seitig) signifikant.

*. Die Korrelation ist auf dem Niveau von 0,05 (2-seitig) signifikant.

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