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Effects of noise information provision on aircraft noise tolerability: Results from an experimental study

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ABSTRACT

The maximum number of flights tolerated by airport-area residents is affected by their access to information concerning their neighbors who are affected by the noise. This study explored the effects of providing descriptions of noise exposure conditions on the tolerance of aircraft noise by residents living near Manila Airport in the Philippines. A questionnaire assessed different levels of noise in a hypothetical situation involving the affected zones. Face-to-face interviews were conducted using prerecorded aircraft noise presented via headphones. The information about the overall noise situation at an airport lowered the tolerance of overhead flights, compared to the baseline levels. The participants tolerated more flights when they were informed about the situation of people who were more severely affected by the noise than they were. This tendency strengthened with an increase in the severity of the noise situation in other areas. The economic benefits associated with an increase in air transport demand were also observed to boost noise tolerance. The findings provide insights into proper information provision, which should benefit the noise-management personnel of airports.

1. Introduction

Airport operations and growth are often hindered by community pressure. The level of opposition to a development plan or change in the operational flights at an airport varies considerably with the amount and kind of aircraft noise information these communities receive. When information is given, the most aggrieved people are those whose expectations about aircraft noise in their living areas have not been met (Commonwealth of Australia (2003)). For instance, people who have homes located outside of the noise contour map become very annoyed even by the relatively low levels of aircraft noise, because of a false expectation that there would be no noise over their home. Often, these people have an implicit, rather than an explicit, expectation about aircraft noise. Sufficient information is likely to reduce community opposition to aircraft operations and growth in various ways. For instance, information about where the aircraft fly, how noisy, how often, and at what time, enables people to obtain an overall expectation of aircraft noise exposure levels in order to make decisions such as whether to purchase a house/land nearby or to stay at home during a specific time of day.

Noise monitoring stations have been installed at several airports (Asensio et al., 2012), where information on the overall noise situation (e.g., operational flight routes, noise contour map) is released regularly through various media, including newspapers and magazines. The information can now be accessed easily and conveniently anytime online. In some cases, airport-area residents are highly informed about the impact of aircraft noise over their areas, as well as the potential impact of airspace redesign or the addition of runways. Consequently, the residents oppose the growth of air traffic without appropriately considering noise mitigation measures (e.g., FAA airspace redesign and the possible third runway at Heathrow Airport). To some extent, this noise opposition is linked to political matters.

Further, hindered airport development plans are associated with a failure on the part of some governments to accept research findings showing the adverse effects of aircraft noise on human health. As a result, they have not been able to develop effective ways to lessen these adverse effects. Since citizens worldwide are becoming more informed about the hazards of aircraft noise, they

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are quick to complain about the change in noise exposure levels or flight operations near their living areas. It is usually necessary to provide citizens with a comprehensive explanation of the noise situation to resolve their complaints.

Sufficient information about noise must be provided for several reasons (Commonwealth of Australia (2003)). First, the information (particularly on long-term trends in pollution levels) could be useful in the planning process to help the government provide meaningful responses to the complaints raised by the public. Providing accurate and comprehensive information is a fundamental strategy in effectively resolving complaints from communities. In addition, this information can be provided to all prospective buyers of real estate near airports, thus ensuring that people make an informed choice when purchasing property in noise-sensitive zones. This information is useful to decision-makers for future projects involving airports or airspace. Hence, noise information should be sufficient, accurate, and comprehensible to lay people (i.e., not jargon-heavy). The ability of an airport to provide substantial information depends on the availability of the necessary monitoring data.

Information on aircraft noise exposure patterns is now becoming available and accessible at several airports (e.g., in Australia, Japan, and the UK). However, the way in which this information actually affects communities' reactions to the resulting aircraft noise remains an open question. We therefore aim to address this concern by exploring the effects of noise information provision on individual aircraft noise tolerability, such as the maximum tolerable flight frequency (MTFF). More specifically, we examine whether the tolerability of airport noise is affected by the noise descriptions in the noise information provision. We also pay special attention to the variation in MTFFs when individuals compare their own situation to the situations of people who are more severely affected by the noise. The effects of noise information on the MTFFs were investigated in a hypothetical scenario involving a capacity expansion plan at an airport, using a stated preference approach. The adverse effects of aircraft noise resulting from planning are beyond the scope of this study.

As observed in the previous research, the information about the overall noise situation at an airport provided to the public is likely to have a negative influence on their propensity to tolerate the noise of numerous overhead flights. This study verifies the idea that influencing the individual's attitude towards the noise source in a positive way can lower his or her reaction to noise (Kroesen et al., 2011). Further, an individual's consideration of other people's situations involves the concept of social interaction (Fleiter et al., 2010; South and Baumer, 2000). To a lesser extent, we focus on the "contextual interaction" defined by Manski (2000); that is, the propensity of an individual to behave in a certain way varies with the exogenous characteristics of other people in the same social group. If the effects of other people's noise situations could be identified, one possible contribution of this study is that our methodology can be further developed to obtain useful data that enable an improvement in the analytical models of individual/social learning (Ben-Elia and Shiftan, 2010; McElreath et al., 2005).

2. Relevant literature

2.1. Noise effects and mitigation

For decades, aviation authorities have struggled with noise complaints from airport-area communities. Noise at an airport has several adverse consequences such as annoyance (Babish et al., 2009; Schreckenberg et al., 2010), decreased residential satisfaction (Kroesen et al., 2010), sleep disturbances (Basner and Samel, 2006), and other health effects (Hansell et al., 2013; World Health Organization [WHO], 2011). Because more people are becoming aware about the health hazards of aircraft noise (WHO, 1999), the available airport noise information appears to have a negative effect on the residents' attitudes. Further, noise information reduces the property values around the airport (Nelson, 2004). Evidence of this effect has been provided by Pope (2008), who developed a hedonic model to estimate the effect of asymmetric disclosures (i.e., information provided only to some neighborhoods) about airport noise on the residential housing market around Raleigh–Durham International Airport (RDU) in North Carolina. The author found that the airport noise disclosure increased the price discounts for houses near RDU, compared to the prices of similar homes purchased prior to the disclosure. In addition to the marginal value of airport noise, information about the level of noise provided to the public might partially affect their choice of residential location.

Several noise mitigation strategies have been developed and refined, including the production of quieter aircraft and the adjustment of operational procedures (see Girvin, 2009). Recent studies have found that each takeoff/landing flight trajectory could be optimized to minimize the impact of aircraft noise on people living near the airport (Prats et al., 2011; Visser, 2005). These studies are useful in mitigating aircraft noise over noise-sensitive areas (e.g., hospitals, schools, and shrines).

Another strategy is noise sharing, which has been used in, for example, the Long Term Operating Plan (LTOP) at Sydney airport (Airservices Australia, 1996) and the runway alternation procedure at London Heathrow airport (Britain's TI, 2009). This practice could prevent noise from being concentrated over only some groups of people residing along the conventional flight routes; that is, noise-affected residents are provided a respite period. On a long-term basis, noise sharing implies that aircraft noise is distributed as fairly as possible over multiple areas near the airport (Nero and Black, 2000). However, it is difficult to put noise sharing into practice without obtaining consensus among communities living in these areas. Providing information about airport noise can be a means of achieving tolerance from these communities. Planners need to not only determine the level of noise tolerance but also consider the long-term effects of aircraft noise exposure (Clark et al., 2013).

2.2. Noise perception

Airport-area communities often have different views on airport development. A frequent cause of complaints is individual differences in the perception of aircraft noise effects (Hume et al., 2003; Stockbridge and Lee, 1973). At Fukuoka airport in Japan, for example, many residents along the flight paths have welcomed the airport's expansion (i.e., an additional runway) rather than the construction of a new airport at another place (Phun et al., 2015a). Despite the exposure to high noise levels, these residents tolerated rather than opposed the noise. In contrast, noise-distribution measures at Haneda airport have resulted in complaints from individuals living far from the airport (Phun et al., 2013). They have demanded noise reduction even though they were exposed to noise levels lower than the environmental noise standard. These residents received fewer benefits (e.g., job opportunities and business improvement) from Haneda airport than did those near Fukuoka airport. Thus, it appears that the perception of airport noise is influenced by several factors, including sound intensity, time of day, activities, emotional variables, social status, and the availability of information about aircraft noise.

2.3. Maximum tolerable flight frequency

Although many studies have used noise exposure levels as a