Noise and Performance

Laboratory studies of the effects of noise on performance have found that noise has a detrimental effect on tasks involving vigilance, memory and divided attention. They have also indicated that its effects vary depending on the nature of the noise (including volume, predictability and perceived control) and the type of task that participants are asked to undertake (Glass and Singer, 1972). However, there are two major problems with using laboratory studies to investigate the detrimental effects of noise:

- In the laboratory it is possible to detect very small changes in participants' psychological functioning that may be irrelevant where it comes to their performance on everyday tasks.
- In addition, laboratory-based research may use tasks and types of noise that are unlike those to be found in real-world situations.

Many researchers, therefore, have extended research into noise effects into more ecologically valid contexts. These include schools and places of work.

Noise and Education

A great number of studies have been conducted into the potential effects of noise on children's educational performance. The findings from laboratory studies have been validated, that is, noise, especially at high levels, is associated with a measurable decline in educational performance. Cohen et al (1986) found that children living near airports showed poorer problem solving abilities compared to controls and Evans et al (1993) found that children living near an airport in Germany were lacking in motivation and less tolerant of frustration compared to controls. However, these and other such studies have been criticised for having restricted samples and for failing adequately to control for other variables that may affect performance, such as social disadvantage or being educated in a second language (Haines et al, 2001)

Much of the current research has been conducted in schools situated near major roads or airports. Both of these are significant sources of noise whose impact is likely to grow over the near future. As this chapter is being written, British newspapers are reporting that UK air traffic is likely to increase from nearly 140 million passengers per year in 2002 to as many as 400 million passenger per year by 2020 (*The Guardian*, 24th July 2002). This will obviously result in a considerable increase in the number of flights made and consequently will increase the overall noise output of air travel in the UK.

To investigate the impact of air traffic noise on educational performance, a large scale study by Haines et al (2001) compared children from 10 primary schools in the vicinity of Heathrow airport (the UK's busiest) with children from 10 matched primary schools exposed to lower levels of aircraft noise. They found that exposure to aircraft noise was not associated with generally impaired performance. No differences were found between the two groups in tests of memory and sustained attention. However, children chronically exposed to noise showed a slight reading impairment for material at the higher end of the difficulty scale. Additionally, children in schools near the airport were more susceptible to noise induced annoyance. This effect was slightly more marked for non-white children who did not speak English at home, which may reflect cultural differences in sensitivity to noise exposure. However, apart from this minor observation, Haines et al did not report that children from vulnerable groups were generally more susceptible to the effects of aircraft noise.

Although this research did not identify a generalised cognitive effect of chronic noise exposure, Haines et al were sufficiently concerned about the specific effects on noise to suggest that schools situated near the airport constitute a disadvantaged learning environment and to recommend that their findings be taken into consideration in the planning of future air-transport provision.

Looking at the effects of traffic noise on educational performance, Shield and Dockrell (2002) carried out a **correlational study** to assess whether noise levels at primary schools in three London Boroughs were related to children's results in the Standardised Assessment Tests (SATs) taken in British state schools at ages 7 and 11. They found that in all the schools assessed the level of noise in the environment (primarily from road traffic but also from aircraft)

exceeded the recommended maxima laid down by the Department for Education and Employment (DfEE) and the World Health Organisation (WHO). They found a slight negative correlation between average noise level and SATs attainment. That is, higher levels of noise were associated with poorer SATs results. This was particularly the case for the tests that assessed English and was more evident in the 11 year-olds than the younger children.

Findings such as these demonstrate that noise from the environment has a small but significant effect on children's school performance. Consequently it could be concluded that children that attend school in noisy environments such as in highly urbanised areas or near airports and major roads are at an educational disadvantage. Such research highlights the need for those that plan transport provision to take into account local schools in the planning process. Additionally, such research might have consequences for the ways in which school buildings are designed. If high levels of noise adversely affect children's development it seems clear that in the design of new and the renovation of existing school buildings consideration should be given to adequate soundproofing or other noise reduction strategies.

Noise in Office Environments

Many people these days have jobs that are office based. Since office work may involve a substantial cognitive component, some researchers have investigated whether the performance effects of noise found in the laboratory can also be identified in office settings.

One line of enquiry concerns a phenomenon known as the **irrelevant speech effect** (ISE) whereby performance on cognitive tasks tends to decline noticeably when participants are exposed to noise that contains irrelevant speech (even in a language the participant does not speak). Banbury and Berry (1998) carried out a series of **field experiments** in an open-plan office environment. Participants were given tasks involving mental arithmetic and prose memory and were tested under three conditions. In the first condition, participants were exposed to non-speech office noise, in the second they were exposed to office noise that included speech and the third was a control condition (quiet). They found that for prose recall, performance declined in both the noisy conditions compared to the control condition. However, noise without speech only affected performance on the mental arithmetic task.

These findings suggest that the performance effects of noise seen in the laboratory occur in real world situations. However, they also highlight the important possibility that the *content* of the noise to which people are exposed will affect the extent to which their performance is impaired on different types of tasks. This could have consequences for office design. Banbury and Berry's findings might be taken to indicate that an open-plan office design, in which workers are likely to be exposed to higher levels of speech-based noise, may have a detrimental effect on certain types of work. It should be pointed out, however, that in practice choice of office design is unlikely to be affected by such considerations and will be more influenced by economic and social factors.