Acoustics 2019
Sound Decisions: Moving forward with Acoustics

Learned helplessness: effect on future performance from noise and negative past performance

Marion Burgess (1,2), Brett R. C. Molesworth (1),

(1) School of Aviation, University of New South Wales, Sydney, NSW 2052 Australia
(2) School of Engineering and Information Technology, University of New South Wales, Canberra, ACT 2600 Australia

ABSTRACT

Learned helplessness can occur when individuals learn that their behaviour is independent of a situation and hence this leads to an effect on future behaviour. This study examined if it was possible for noise, similar to workplace noise, to induce learned helplessness. The findings highlight the complex interaction between noise, performance and motivation.

1 INTRODUCTION

Learned helplessness is a basic principle of behavioural theory concerned with the effect on prior learning on future performance. In other words, learned helplessness occurs when an individual (or animal) learns that his/her behaviour is independent of a situation. Consequently this affects future behaviour when faced with the same situation (Overmier & Seligman, 1967).

It was first demonstrated with dogs in a shuttle box task using electric shocks as the aversive stimuli (Seligman & Maier, 1967). The tests involved two groups and two stages. In both stages, the both groups of dogs were administered electric shocks. In stage one however, one group of dogs (escape group) were able to take action to escape the shocks and jump out of the shuttle box. The other group (inescapable condition) were able to take the same action, but this did not allow them to escape the shocks. In the second stage, electric shocks were again administered to the dogs, however in this stage all dogs could escape. It was found that in the second stage, 75% of the dogs who were unable to escape the shocks (inescapable condition) in the first stage failed to take action to escape/avoid the shocks. Thus they had learned to be ‘helpless’ in the first stage and essentially lacked motivation to try in the second stage.

Hiroto (1974) found ‘learned helplessness’ could be induced in humans, using loud, short bursts of noise (3,000 Hz tone) as the aversive stimuli. For the group in the ‘escape’ condition in both the first and second stage their actions could stop the tone. Those in the ‘inescapable’ condition ‘learnt’ in the first stage that no matter what actions they took the tone did not cease. This affected their motivation in the second stage with a clear reduction in performance when compared with both the control group and the group that had learnt in the first stage that they could escape. The apparatus used to control the sound was a mechanical system similar to the shuttle box in the studies by (Seligman & Maier, 1967). A knob protruded from a box within which was a mechanical system with microswitches. Either the left or right microswitch would stop the sound for one presentation and for the next presentation the microswitch on the other side would stop the sound.

Certain individuals exhibit a personality type that shows similar characteristics to learned helplessness. Locus of control, described as a dispositional trait (Judge & Bono, 2001) is concerned with the level of control an individual believes s/he has over factors that impact his/her life (Rotter, 1996). An individual who believes s/he has control over these factors or has no control is conceptualised as an ‘internal’ or ‘external’ respectively.

The aim of this study was to extend the research by Hiroto and others and examine if ‘learned helplessness’ can be an outcome of exposure to two different types of noise that can be experienced in workplaces and over which the worker has little control; namely broadband and 'babble' noise. As well the study investigated if there was a relationship between locus of control and the induced learned helplessness.

2 TEST METHOD

A computer based task was developed to follow the model of the mechanical test used by Hiroto. The app controlled the sound type as either broadband or babble, the sound duration for each presentation to a maximum of 30 sec with a 10 sec gap between. The app allowed for a combination of the keyboard arrow left, right, and up keys to silence the noise. The app could be altered to disable this functionality of the arrow keys. The task in the second stage was made just a little more complex by requiring alternating three key strokes while the first stage only required same two keystrokes to silence the noise for the escape group. This increase in complexity followed from the work of Teodorescu and Erev (2014) who found learned helplessness can be moderated through the reward frequency and complexity of the escape response. Low frequency of rewards, and a more complex escape response increased the likelihood of learned helplessness.

The 66 participants were divided into one of three groups: one group had the ability to escape in both the first and second stage, another had no ability to escape in the first stage as, unknown to them, the keyboard had been deactivated, but did have the ability in the second stage. The third group was the control group and only participated in the second stage.

It was important to determine if learned helplessness could be induced and if there was a difference between the two types of noise. The broadband and babble noise were produced via the app and the level set at 75dBA. This is below a hearing hazard level of 85 dBA but would be considered a high value for an office workplace. However there are workplaces where personnel are required to undertake cognitively challenging and safety critical tasks while exposed to such noise. Transportation is one such example. Measurements by the authors over a range of aircraft have shown noise level in the cabin of commercial aircraft during cruise to be broadband and typically 75 to 80 dBA. Cabin staff have to work in these areas for long periods of time. Also measurements by the authors have shown similar noise levels in busy check-in and booking areas where the staff are exposed to chatter or babble from the adjacent work stations and from the waiting customers.

Along with the audiometric check, each participant completed a a demographics questionnaire (i.e., age, sex, language background), Rotter's Locus of Control scale, and three questions for a subjective response to noise.

3 FINDINGS

In this study, 40% of the participants who were unable to escape the noise in stage one 'gave-up' in stage two. In contrast, no participant from the escape group 'gave-up', see Figure 1. This demonstrates that an experience of a noise over which they have no control, can adversely affect individuals' motivation to perform when again presented with the same noise. No differences were noted from the assessment of locus of control indicating that the effect is due to the noise and not due to 'internal' or 'external' personalities

The difference in the effects of noise type is highlighted by the findings that participants in the escape group and exposed to broadband noise successfully escaped/avoided the noise more frequently than the participants who were exposed to babble noise. However, the subjective responses indicated that the participants did find broadband noise more annoying than the same level of babble noise. Full details of the findings are included in Molesworth, Burgess & Wilkinson (2020).

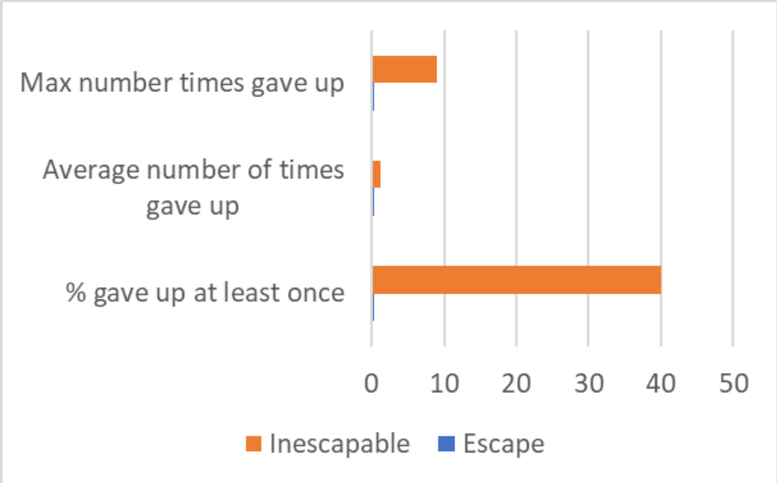

Figure 1: Comparison of performance - note that the performance for the escape group was zero for each of these categories

4 CONCLUSION

This study illustrates that babble and broadband noise at 75 dBA can lead to the effect of learned helplessness and by inference reduce motivation. When it is possible to escape from noise, the type of noise also affects performance, with babble noise adversely affecting individuals' ability to escape more than broadband noise (i.e., babble noise affects performance). Personality, such as 'locus of control' was not found to modulate this effect. Further investigations could demonstrate if lower levels of noise at say 65 dBA also induces learned helplessness.

ACKNOWLEDGEMENTS

First and foremost, we would like to thank Australian Acoustical Society for supporting this project (Australian Acoustical Society Education Grant). We would like to thank all participants who volunteered their time to assist with the research. We would also like to thank Benjamin Kaebe who designed the computer app employed in this research and Angus Willis who assisted with coding the data.

REFERENCES

Hiroto, D. S. 1974. "Locus of control and learned helplessness'" *Journal of Experimental Psychology*, 102(2), pp. 187-193.

Judge, T. A., & Bono, J. E. 2001. "Relationship of core self-evaluations traits-self-esteem, generalised self-efficacy, locus of control, and emotional stability – with job satisfaction and job performance: A meta-analysis," *Journal of Applied Psychology*, 86, pp. 80-92.

Molesworth, B. R. C., Burgess, M., & Wilkinson, J. 2020. "Can babble and broadband noise present in air transportation induce learned helplessness? A laboratory based study with university students." *Applied Acoustics*, 157 (https://doi.org/10.1016/j.apacoust.2019.107016)

Overmier, J. B., & Seligman, M. E. P. 1967. "Effects of inescapable shock on subsequent escape and avoidance learning," *Journal of Comparative and Physiological Psychology*, 63(1), pp. 28–33.

Rotter, J. B. (1966). "Generalized expectancies for internal versus external control of reinforcement," *Psychological Monographs*, 80, pp. 609.

Seligan, M. E. P., & Maier, S. F. 1967. "Failure to escape traumatic shock," *Journal of Experimental Psychology*, 74(1), pp. 1–9.

Teodorescu, K., & Erev, I. 2014. "Learned helplessness and learned prevalence: Exploring the causal relations among perceived controllability, reward prevalence, and exploration," *Psychological Science*, 25(10), pp. 1861-1869.