

INDIVIDUAL DIFFERENCES IN STRESS RESPONSES
OF WORKERS EXPOSED TO INDUSTRIAL NOISE -

A Cognitive Psychophysiological Approach

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Synopsis

The main objective of the present study was to identify the characteristics of individuals who are sensitive to industrial noise exposure; and who will manifest stress responses (both physiological and behavioral) at moderate noise levels (permitted by the noise regulations). A theoretical search, based on the information-processing approach, of the mechanism behind this sensitivity has led to portraying individual differences in levels of processing. This involves defining a cognitive typology - "organizers" vs. "non-organizers" who differ, among other things, in their ability to handle nonsense and non-organizable stimulation, that can not be mentally reduced (by imposing abstract categories or patterns upon it), such as noise (and other environmental stressors such as heat, vibrations, random motions, etc.).

The organizers are characterized as relying heavily on handling environmental and inner stimulation by mental operations involving abstract schemata, which lead to its massive decrement. Thus they are conceived as having smaller absorption capacity for non-organizable (irreducible) stimulation than non-organizers. Therefore, organizers were expected to be more sensitive to noise, since the absorption of the noise in addition to the environmental and inner stimulation stemming from performing their work, is apt to lead to mental overload and the consequent stress responses.

An additional variable examined in the study was Type A personality. It was assumed that this variable will interact with the cognitive style of organization to determine workers' reactions to noise. An additional aim of this study was to examine the effect of noise reduction (by using ear protectors) on the noise-induced stress responses, especially for the organizers.

The study was performed on 25 textile workers, employed in a spinning mill. 16 workers were identified as organizers and 9 as non-organizers, on the basis of their performance of a certain dual task – both tasks being of regular pacing - which was found in a pilot study to reflect levels of cognitive organization. The ambient noise level in the mill was 75-95 dB(A).

The results of the study indeed indicate that the organizers are more sensitive to noise:

- 1) Significant correlations were found between cognitive organization and both reported annoyance by the noise, and post-noise effect of exhaustion (exhaustion reports cover a variety of symptoms experienced after work, which include heightened fatigue, irritability, low frustration threshold, impatience for social interaction and a desire for low-level, 'sensory isolation' sort environmental stimulation").

Furthermore, for Type A workers (those who were above the median on the Type A scale) the stress responses were more marked, reflected in high correlations of cognitive organization with noise annoyance (.81), exhaustion (.81) and with somatic complaints and work dissatisfaction. On the other hand, no significant correlations were found for Type A on its own and stress responses. This indicates that Type A acts as a modulator of stress responses for the organizers (Additional analysis has indicated that Type A and cognitive organization are two independent traits).

2) The higher sensitivity to noise of the organizers is also reflected in the improvement shown in measurements taken before and during the use of ear protectors (a manipulation which enabled one to examine the "net" effect of noise, since workers continued with the same work in both conditions - with and without wearing ear protectors). This improvement was manifested (in objective measures) by an increase of the cortical arousal level (as measured by the CFF, Critical Flicker Fusion Frequency threshold) and decrement in the urinary cortisol level (reflecting stress responses) from the very start of work shift, where protectors were used. In addition, with noise reduced, organizers showed the normal diurnal rhythm in cortisol excretion, which had been altered during their exposure to ambient noise. In this condition, their reported fatigue at the end of the work shift was significantly reduced. Such an improvement was not manifested by the non-organizers. Although they also showed higher regularity in cortisol excretion with noise reduction, the above mentioned parameters were changed in a direction opposite to those manifested by the organizers: Already from the beginning of the work shift their cortisol level was higher and their cortical arousal was lower relative to their baseline under noise exposure, and relative to the values of the organizers. The non-organizers did not report any significant decrease in subjective fatigue as a result of noise reduction.

3) Sickness absences were significantly higher for the organizers than for the non-organizers.

The theoretical distinction between organizers and non-organizers was further supported by:

a) A differential pattern in changes of the CFF threshold during the work shift, and by the fact that organizers had by and large higher CFF thresholds than non-organizers.

b) The finding that the CFF significantly increased after the dual task performance for organizers but not for non-organizers.

The findings of the study, which permit the identification of workers who will exhibit stress responses at moderate levels of noise exposure, have practical value. The parameters used in the study can be utilized to identify those workers who are likely to be adversely affected by noise - prior to noise exposure. It is therefore advisable to focus the enforcement of ear protectors on these workers, or try and place them in work stations with reduced noise.

The first recommendation would be, however, relatively hard to implement, since the study revealed that the workers sensitive to noise will be those who will resist wearing protectors (because of pressure, sweat, etc), probably for the very reason that makes them sensitive to noise (i.e. sensitivity to environmental stressors). Further studies are needed to cross-validate the findings of the present study and also to examine additional deductions of the theory presented in the study.

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