



**NEGATIVE LIFE EVENTS, DAILY HASSLES, PERCEIVED STRESS, AND
PERFORMANCE OF FOCUSED ATTENTION AND CATEGORIC SEARCH CHOICE
REACTION TIME TASKS**

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ABSTRACT

Background: There has been considerable research on the effects of stress on physiology and health. Fewer studies have examined associations between stress measures and cognitive performance. There are many different measures of stress, some investigating the occurrence of major life events, others more minor daily hassles, and some examining the extent to which demands exceed the ability to cope and lead to perceived stress. In the present study, three stress measures covering different time periods were recorded, and associations between these measures and outcomes from focused attention and categoric search tasks were examined. The effects of age were also covaried. **Method:** Two hundred and seventy staff or students (159 females, 113 males; mean age 35.4 years, age range 17-65 years) from Cardiff University were recruited. Two hundred and fifty had complete data and they were included in the current analyses. Prior to the laboratory session, the volunteers completed questionnaires measuring negative life events, daily hassles and perceived stress. Participants carried out two choice reaction time tasks, one involving focused attention and the other categoric search. The outcomes from these tasks were mean reaction times, lapses of attention, errors, the speed of encoding new information, response organisation, and selective attention measures. **Results:** Initial correlational analyses revealed no significant associations between the stress measures and the performance scores. MANOVAs showed that negative life effects and perceived stress had significant and opposite effects on the focusing of attention. High negative life events were associated with wide attention, whereas high perceived stress was associated with focused attention. Older participants performed the tasks more accurately but more slowly than younger individuals. **Conclusion:** Measures of stress were largely not significantly associated with the performance measures. The exceptions were negative life events, perceived stress and the focusing of attention. High perceived stress was associated with more focused attention, whereas high negative life event scores were associated with attention being set to a wide angle. Age had a significant effect on performance, and the speed-error trade-off profiles of older and younger participants were different.

KEYWORDS: Negative life events; Daily hassles; Perceived stress; Age; Focused attention; Categoric search; Choice reaction time; Errors; Lapses of attention.

INTRODUCTION

Stressful events have been measured in several ways. Negative life events are significant changes in a person's life which disrupt normal activities. They include events such as bereavement, divorce, losing one's job and debt. These events are associated with increased susceptibility to illness.^[1,2] Daily hassles are the stresses of everyday life and are less severe than major life events.^[3] However, minor daily hassles are frequent and build up to have a cumulative effect that reduces well-being, with participants with the fewest hassles reporting the highest level of well-being. Stress is often defined as demands exceeding the ability to cope. The Perceived Stress Scale (PSS)^[4] was developed to measure the frequency of such situations. It is non-specific in that it does not link the

perceived stress to stressful events. The PSS has been used to assess the stressfulness of different situations, the effectiveness of stress management techniques, and the relationship between stress and physical and mental illnesses. It has significant associations with biological markers of stress, such as cortisol levels and immune markers.

The aim of the present research was to examine associations between the above stress measures and the performance of focused attention and categoric search tasks. Previous analyses have shown that these performance measures were not related to anxiety or depression^[5] nor to mood states over short or long periods.^[6] The exception was negative mood in the week

prior to testing. Those with high levels of negative mood made more errors on both tasks than those with low negative mood.

Focused attention often involves the identification of stimuli in specific known locations followed by an appropriate response. Another type of attention, categoric search, involves identifying where the target is, followed by its identification and appropriate response. These two types of attention have been measured using choice reaction time tasks developed by Broadbent and colleagues.^[7,8] These tasks also measure mean reaction time, lapses of attention (occasional very long reaction times) and errors. They also measure stages of information processing, such as response organisation and the encoding of new information.^[9] Three main measures of attention have been derived from these tasks. The first measure was the focusing of attention (the Eriksen effect, ERIK). The second, measured in the categoric search task, compared the effects of stimuli occurring in the same or different locations on successive trials (the place repetition effect, PREP). The third measure was the difference in reaction times between the two tasks (Spatial uncertainty little: SPUL).

Initial studies with these tasks focused on the associations between selective attention measures, cognitive failures and obsessional personality.^[7] Later research showed that these measures changed when testing was at different times of day.^[8] The global measures and those reflecting different stages of processing have been shown to be sensitive to time of day,^[10,11] sleep deprivation,^[12] shiftwork,^[13] exposure to noise,^[14] minor illnesses,^[15-19] alcohol,^[20,21] chewing gum,^[22,23] ingestion of food,^[24-29] aromas,^[30] caffeine,^[31-39] noradrenergic drugs,^[40,41] cholinergic drugs,^[42] cognitive failures,^[43] chronic fatigue syndrome,^[44] and age.^[45] The present analyses examined whether these tasks were sensitive to stressful events and perceived stress levels.

METHOD

The study was approved by the ethics committee, School of Psychology, Cardiff University, and carried out with the informed consent of the participants.

Design

The participants completed questionnaires measuring stress over periods ranging from the last year to the last month in a session where they were also familiarised with the reaction time tasks. They then completed a test session between 11.00 and 13.00 or 16.00-18.00. This involved focused attention and categoric search tasks. The order of focused attention and categoric search tasks was counterbalanced.

Participants

The participants were recruited from the university staff and students. Two hundred and seventy-two volunteers (113 males and 159 females; mean age 35.4 years, age

range 17-65 years) were recruited, and two hundred and fifty completed the study.

DETAILS OF THE TASKS

Focussed Attention Task

This task was developed by Broadbent et al.^[1,2] Target letters were upper case A's and B's. On each trial, three warning crosses were presented on the screen, with the outside crosses being separated from the middle one by either 1.02 or 2.60 degrees. Volunteers were told to respond to the letter presented in the centre of the screen and ignore any distracters presented in the periphery. The crosses were on the screen for 500 msec and were then replaced by the target letter. The central letter was either accompanied by 1) nothing, 2) asterisks, 3) letters which were the same as the target or 4) letters which differ - the two distracters were identical, and the targets and accompanying letters were always A or B. The correct response to A was to press a key with the forefinger of the left hand, while the correct response to B was to press a different key with the forefinger of the right hand.

Volunteers were given ten practice trials followed by five blocks of 64 trials. In each block, there were equal numbers of near/far conditions, A or B responses and equal numbers of the four distracter conditions. The nature of the previous trial was controlled.

The task gives three main types of outcome measures:

1. Global indicators of speed, accuracy, and lapses of attention.
2. Speed of encoding of stimuli
3. Resistance to distraction and focusing of attention.

Categoric search task

This task was also developed by Broadbent et al.^[1,2] Each trial started with the appearance of two crosses in the positions occupied by the non-targets in the focused attention task (i.e. 2.04 or 5.20 degrees apart). Volunteers did not know, in this task, which of the crosses would be followed by the target. The letter A or B was presented alone on half the trials and was accompanied by a digit (1-7) on the other half. Again, the number of near/far stimuli, A versus B responses and digit/blank conditions were controlled. Half of the trials led to compatible responses (i.e. the letter A on the left side of the screen or the letter B on the right), whereas the others were incompatible. The nature of the preceding trial was also controlled. In other respects (practice, number of trials, etc.), the task was identical to the focused attention task.

The task gives four types of measures

1. Global indicators of speed, accuracy, and lapses of attention.
2. Speed of encoding of stimuli
3. Speed of response organisation
4. Measures of spatial attention.

Questionnaires

The participants completed the following questionnaires measuring stress

- Negative life events^[2]
- Daily Hassles^[3] – frequency, intensity and cumulative severity.
- Perceives stress scale^[4]

RESULTS

Analysis was carried out using IBM SPSS version 27. Initial correlations between the stress measures and the outcome measures from the choice reaction time tasks were then computed. The data from the performance tasks were then analysed with MANOVAS. Age and time of day have been shown to be important predictors of performance of these tasks. The covariates were the stress measures, age and time of day.

Correlations between stress measures and performance

There were no significant correlations between the stress measures and the outcome measures from the performance tasks.

MANOVAS

The measures from the choice reaction time tasks were the dependent variables. The covariates were the stress measures, time of testing and age. The only significant stress effect was found with the Eriksen effect (Perceived stress: $F_{1, 224} = 10.83$ $p < 0.001$; Negative life events: $F_{1, 224} = 4.52$ $P < 0.05$). A high number of negative life events was associated with a lower ERIK score, meaning that those who reported more negative life events had wider angled attention than those with few negative life events (Low negative life events: mean = 16.4 s.e. = 3.0; High negative life events: mean = 8.3 s.e. = 3.1). High perceived stress was associated with a higher ERIK score, indicating more focused attention (Low PSS: mean = 3.2 s.e. = 3.3; High PSS: mean = 21.5 s.e. = 5.3). There were also significant effects of age, with older participants being slower but more accurate than the younger ones.^[46]

DISCUSSION

The aim of the present research was to examine associations between exposure to stressors and perceived stress, measured over several time periods and varying in intensity, and different outcome measures from focused attention and categoric search choice reaction time tasks. The stress measures were negative life events, daily hassles and perceived stress. Effects of age were also examined, as this is an established predictor of the performance of choice reaction time tasks. The global performance measures used were mean reaction times, errors, and lapses of attention (occasional very long reaction times) from the two tasks. In addition, measures of selective attention (SPUL; ERIK; and PREP) were calculated from the tasks. The speed of encoding of new information and response organisation were also measured.

The analyses showed very few associations between the stress and performance measures. The two significant effects were associations between negative life events, perceived stress and the focusing of attention (ERIK). These effects were in opposite directions, with those with higher negative life events having attention set to a wider angle and high perceived stress being associated with more focused attention. These results support research that has shown that chronic and acute stress often leads to different outcomes. Exposure to stressors, such as noise, has often led to changes in the focus of attention. Age had significant effects on speed and accuracy, with older participants performing the tasks more accurately but more slowly. The absence of more effects of stress could be due to stress and performance involving different processes. In addition, the factors influencing individual differences in stress and performance could be different, which would make an association between the two unlikely.

CONCLUSION

There has been extensive research on stress, physiology, and health, but fewer studies have examined associations between cognition and stress. Some stress measures focus on the occurrence of major life events, whereas others address the frequency and intensity of more minor daily hassles. A different part of the stress process involves the appraisal of stress, and these measures examine the extent to which demands exceed the ability to cope and lead to perceived stress. The present study investigated the associations between negative life events, daily hassles, perceived stress and outcomes from choice reaction time tasks involving focused attention and categoric search tasks. The effects of age were also investigated. Two hundred and fifty university staff and students were included in the present analyses. Correlational analyses revealed no significant associations between the performance scores and the stress measures. MANOVAS revealed that perceived stress and negative life events had significant and opposite effects on the focusing of attention. High perceived stress was associated with focused attention, whereas more negative life events were associated with wide attention. Older participants performed the tasks more slowly but more accurately than the younger individuals. In summary, the stress measures were generally not significantly associated with the performance measures. Negative life events and perceived stress were significantly associated with the focusing of attention. High negative life event scores were associated with attention being set to a wide angle, whereas high perceived stress was associated with more focused attention. Age significantly affected performance, with the speed-error trade-off being the opposite in older and younger participants.

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