Conference Proceedings

Short Vigilance Tasks are Hard Work Even If Time Flies

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14. Vigilance research has found that observers find the task to be unpleasant and mentally demanding (Warm, Finomore, Vidulich, & Funke, 2015). However, sustained attention plays a critical role in numerous operational settings where human operators must monitor automated human-machine systems in the event of potential problems. The current study extended the work from Dillard and his colleagues (Dillard, Warm, Funke, Vidulich, Nelson, Eggemeier, et al., 2013) who explored if there are other dimensions that might affect the workload associated with performing a vigilance task. The area that they explored was the temporal context of the vigilance task on its effects on task performance and perceived mental workload. Borrowing from a temporal manipulation procedure developed by Sackett and colleagues (Sackett, Meyvis, Nelson, Converse & Sackett, 2010) in which they manipulated perceived time progression (PTP) of the participant while they performed a cognitive task. Sackett et al., (2010) manipulated the PTP by developing their studies to deceive the participant into thinking the task they were performing was longer or shorter than the actual time. Upon completion of the task, participants filled out questionnaires related to the hedonic and temporal evaluation of the task. Participants that were told the task was longer than they actually participated for (time flies conditions) rated times as flying and the task more as more enjoyable.

15. SUBJECT TERMS
Vigilance, sustained attention, perceived time progression

16. SECURITY CLASSIFICATION OF:
Unclassified

17. LIMITATION OF ABSTRACT: SAR

18. NUMBER OF PAGES 3

19. NAME OF RESPONSIBLE PERSON
Gregory Funke

19b. TELEPHONE NUMBER
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EXTENDED ABSTRACT

Vigilance research has found that observers find the task to be unpleasant and mentally demanding (Warm, Finomore, Vidulich, & Funke, 2015). However, sustained attention plays a critical role in numerous operational settings where human operators must monitor automated human-machine systems in the event of potential problems. The current study extended the work from Dillard and his colleagues (Dillard, Warm, Funke, Vidulich, Nelson, Eggemeier, et al., 2013) who explored if there are other dimensions that might affect the workload associated with performing a vigilance task. The area that they explored was the temporal context of the vigilance task on its effects on task performance and perceived mental workload. Borrowing from a temporal manipulation procedure developed by Sackett and colleagues (Sackett, Meyvis, Nelson, Converse & Sackett, 2010) in which they manipulated perceived time progression (PTP) of the participant while they performed a cognitive task. Sackett et al., (2010) manipulated the PTP by developing their studies to deceive the participant into thinking the task they were performing was longer or shorter than the actual time. Upon completion of the task, participants filled out questionnaires related to the hedonic and temporal evaluation of the task. Participants that were told the task was longer than they actually participated for (time flies conditions) rated times as flying and the task more as more enjoyable.

Dillard et al., (2013) explored the PTP effects in the context of a 30 min vigilance task where observers had to detect the occurrence to aircrafts that were on a collision course. They told participants the task would last for 15 min (time dragged) or 60 min (time flew). They found that participants rating of PTP for the time flies conditions to be rated as “flying by” however they found no differences in the task performance, ratings of perceived mental workload from the NASA-TLX or difference in hedonic ratings of the tasks. This led Dillard and colleagues (2013) to conclude that the temporal context of a vigilance task does not affect the perceived workload or performance of the participant. However, the duration of the task in Dillard et al., (2013) was up to three times longer than Sackett at el., (2010) which could result in the null effects found in perceived workload and hedonic ratings. The current study utilized the short vigilance task which was developed by Temple and his colleagues to be an analogue of longer tasks (Temple, Warm, Dember, Jones, LaGrange, & Matthews, 2000). Similar to longer duration vigilance tasks been shown by its sensitivity to psychophysical attributes such as stimulus salience and to stressors including caffeine and noise (Helton et al., 2009; Temple et al., 2000). It also elicits subjective and hemodynamic responses resembling those seen with longer tasks (Helton et al., 2007, 2009). This task is 12 min in duration which closely resembles the task times used in Sackett et al. (2010) studies. The goal of the current study is to reexamine the temporal effects of PTP on a short vigilance task with similar task duration from Sackett at el., (2010) to see if it has an effect on performance, hedonic ratings, or perceived mental workload.

METHOD

Participants
In the experiment, 51 students from the United States Air Force Academy served as observers. They ranged in age from 18 to 24 years. All of the observers had normal or corrected-to-normal vision and participated to fulfill course requirement.

Design
A 3 (Temporal Manipulation) x 6 (Periods of Watch) mixed experimental design was employed. Seventeen participants were assigned at random to one of three experimental conditions. The three conditions were defined based on the duration of the task told to the participant and displayed on the computer monitor. Participants were told that the task, which actual duration was 12 min, would last 6 min (time drags), 12 (control- actual time) min, or 24 (time flies) min.

Immediately following the 12 min vigil, the participants filled out a hedonic and temporal evaluation of the task on a 7-point scale. This scale was identical in nature to Sackett et al. (2010) and Dillard et al. (2013) which consist of eight questions related to the enjoyment of the task, engagement, fun, challenge, skill required, pleasantness, and willingness to participate in a longer task in the future. The participants were also asked to indicate how time seemed to progress on a similar 7-point scale (1 = time dragged, 7 = time flew). Following the hedonic and temporal evaluation the participant completed the NASA-Task Load Index (NASA-TLX; Hart & Staveland, 1998) The NASA-TLX is a well-regarded instrument for the measurement of perceived mental workload (Finomore, Shaw, Warm, Matthews, & Boles, 2013; Warm, Matthews, & Finomore, 2008; Warm, Finomore, Vidulich, & Funke, 2015). It provides a global measure of workload on a scale from 0 to 100 and also identifies the relative contributions of six sources of workload: mental demand, temporal demand, physical demand, performance, effort, and frustration.
RESULTS & DISCUSSION

Similar to Dillard et al. (2013) the results of this study found no difference between the experimental conditions regarding the temporal manipulation for task performance, hedonic ratings, and perceived mental workload. Performance in all conditions declined significantly over time which is typically found in sustained attention tasks, See Figure 1.

Figure 1. Mean percentage of correct detection for the three temporal manipulations as a function of periods of watch. Error bars are standard errors.

Participants in all three conditions rated the pleasantness of the task as low, Table 1, and high in perceived mental workload, Figure 3.

Table 1. Mean Enjoyment Scores and Standard Errors

<table>
<thead>
<tr>
<th>Condition</th>
<th>Mean</th>
<th>SE</th>
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<tbody>
<tr>
<td>6</td>
<td>3.07</td>
<td>0.23</td>
</tr>
<tr>
<td>12</td>
<td>2.65</td>
<td>0.14</td>
</tr>
<tr>
<td>24</td>
<td>3.22</td>
<td>0.13</td>
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</table>

Figure 2. Mean NASA-TLX scores across conditions. Error bars are standard error.

This study did replicate the ratings related to the PTP, see Figure 3. Participants rated the condition where they were told would take 24 min when in reality they worked for 12 min as “time dragged”.

While Sackett et al. (2010) was able to find that accelerating the participant’s PTP led to higher rating in the pleasantness of the task which were mundane, tedious, irritating, and challenging, this did not translate to participating in a sustained attention task. This finding confirms Dillard et al. (2013) conclusion that the temporal context is not a moderating variable for the perceived mental workload of a vigilance task. Additionally these results confirms the finding that participants find vigilance tasks as unpleasant and mentally demanding tasks (Warm, Parasuraman, & Matthews 2008) and even when the perceive time to fly by.

REFERENCES


