

# Independent Coactors May Improve Performance and Lower Workload: Viewing Vigilance Under Social Facilitation

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**Objective:** The purpose of the present study was to examine the effects of an independent coactor on vigilance task performance. It was hypothesized that the presence of an independent coactor would improve performance in terms of the proportion of false alarms while also increasing perceived workload and stress.

**Background:** Vigilance, or the ability to maintain attention for extended periods, is of great interest to human factors psychologists. Substantial work has focused on improving vigilance task performance, typically through motivational interventions. Of interest to vigilance researchers is the application of social facilitation as a means of enhancing vigilance. Social facilitation seeks to explain how social presence may improve performance.

**Method:** A total of 100 participants completed a 24-min vigil either alone or in the presence of an independent (confederate) coactor. Participants completed measures of perceived workload and stress.

**Results:** The results indicated that performance (i.e., proportion of false alarms) was improved for those who completed the vigil in the presence of an independent coactor. Interestingly, perceived workload was actually lower for those who completed the vigil in the presence of an independent coactor, although perceived stress was not affected by the manipulation.

**Conclusion:** Authors of future research should extend these findings to other forms of social facilitation and examine vigilance task performance in social contexts in order to determine the utility of social presence for improving vigilance.

**Application:** The use of coactors may be an avenue for organizations to consider utilizing to improve performance because of its relative cost-effectiveness and easy implementation.

**Keywords:** coacting, social facilitation, sustained attention, human performance

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## INTRODUCTION

Vigilance, or the ability to maintain attention over extended periods and to respond to critical events when they occur (Davies & Parasuraman, 1982), has been at the forefront of human factors research for almost 70 years (Fraulini, Hancock, Neigel, Claypoole, & Szalma, 2017). Vigilance tasks can be cognitively demanding and also boring (Scerbo, 2001), and as such, performance tends to decline with time on watch (Mackworth, 1948, 1950). This pattern is referred to as the vigilance decrement (Mackworth, 1948) and is considered to be the most ubiquitous finding associated with vigilance (Fraulini et al., 2017). Thus, a major concern in previous research has been to identify ways to attenuate the decrement. These studies have indicated that interventions, such as rest breaks (Arrabito, Ho, Aghaei, Burns, & Hou, 2015; Helton & Russell, 2015, 2017; Ross, Russell, & Helton, 2014), monetary reward (Esterman et al., 2016; Sipowicz, Ware, & Baker, 1962; Smith, Lucaccini, & Esptein, 1967), and knowledge of results (Sipowicz et al., 1962; Szalma, Hancock, Dember, & Warm, 2006; Warm, Epps, & Ferguson, 1974), can reduce the decrement. More recently, efforts to improve vigilance have shifted to include paradigms from other domains of psychology. One such paradigm is the construct of social facilitation.

*Social facilitation* refers to how social presence affects performance (Aiello & Douthitt, 2001; Bond & Titus, 1983). Typically, social facilitation is characterized by improved performance on simple, or well-known, tasks and impaired performance on complex, or unfamiliar, tasks when in the social presence of another person (Bond & Titus, 1983; Cottrell, 1972; Zajonc, 1965). Social presence can occur in different forms, such as mere presence (Zajonc, 1965), evaluative presence (Cottrell, 1972),

coacting (Klinger, 1969), competitive presence (Strauss, 2002), or electronic presence (known as electronic performance monitoring; Aiello & Douthitt, 2001). Previous research has suggested that the different forms of social presence are not equivalent in their effects, such that the forms of social presence that are more arousing (i.e., evaluative) tend to have a greater impact on performance (Cohen & Davis, 1973).

To date, vigilance performance in the context of social facilitation has been explored in only a handful of studies (Bergum & Lehr, 1962, 1963; Claypoole & Szalma, 2017; Funke et al., 2016; Klinger, 1969; Morgan & Alluisi, 1965; Putz, 1975; Yu & Wu, 2015). Overall, these studies suggest that the various forms of social facilitation (i.e., mere presence; Yu & Wu, 2015; evaluative presence; Bergum & Lehr, 1963; and coacting, Funke et al., 2016) tend to improve performance in terms of higher correct detections (e.g., Bergum & Lehr, 1963; Funke et al., 2016), fewer false alarms (e.g., Claypoole & Szalma, 2017), or faster response times (e.g., Yu & Wu, 2015); however, this effect has not been examined in terms of manipulating task difficulty as suggested in traditional social facilitation research. Thus, although the traditional theories of social facilitation suggest that performance on a novel or complex task is typically impaired, most research utilizing a vigilance task (a task that is by nature hard work and stressful; Warm, Matthews, & Finomore, 2008) has shown performance improvements rather than impairments.

The researchers who have examined the effects of a coactor on vigilance task performance all utilized a sensory vigilance task (Bergum & Lehr, 1962; Funke et al., 2016; Klinger, 1969; Morgan & Alluisi, 1965), with either correct detections (hits; Bergum & Lehr, 1962; Funke et al., 2016) or signals missed (Klinger, 1969; Morgan & Alluisi, 1965) as the performance measure of interest. Although it is common to report all measures of performance (i.e., hits, false alarms, response time) as well as measures of signal detection (i.e., sensitivity, response bias), most of the aforementioned experiments failed to do so. Thus, there is virtually no information on how coacting affects response time or signal detection measures of sensitivity and

response bias. Furthermore, half of these studies reported no significant differences, such that the use of an independent coactor did not result in either more signals detected (Bergum & Lehr, 1962) or fewer signals missed (Klinger, 1969) when compared with subjects who completed the vigil alone.

The most robust findings on the effect of an independent coactor have come more recently from Funke et al. (2016). In their sensory vigilance task, independent coactors detected significantly more critical signals than participants working alone, but there were no significant difference in the proportion of false alarms between coactors and single observers. However, response time and signal detection analyses were not reported. Funke et al. were also the first to investigate the effects of coacting on perceived workload and stress. Their results indicated that although coacting did not affect perceived workload, single observers reported higher levels of distress than those working in the presence of a coactor, suggesting that working as an independent coactor may reduce the stress of vigilance (Funke et al., 2016).

It is important to note that the use of independent coactors and the use of teams are separate, distinct literatures (Clement, 1973; Sorkin, Hays, & West, 2001; Waag & Halcomb, 1972; Weiner, 1964), and as such, team vigilance tends to have a different effect on performance than the presence of an independent coactor (Sorkin et al., 2001). Particularly, research has demonstrated that the performance of team vigilance may depend on a variety of factors, including group size, competency of its members, correlations among their judgments, decision rules, and constraints on communication (Sorkin et al., 2001). Independent coactors are not affected by the competency of membership or by their combined judgements and decision-making processes.

### The Present Study

The purpose of the present study was to further examine the effects of independent coacting on vigilance task performance. The effects of social presence on vigilance task performance are still unclear, and most experiments dealing with the effects of an independent coactor

have used a sensory vigilance task. However, previous research has suggested that cognitive and sensory vigilance tasks may differ in their effects on performance efficiency (Davies & Tune, 1969; Deaton & Parasuraman, 1993; Dember, Warm, Bowers, & Lanzetta, 1984; See et al., 1995), and there have been calls for further research to examine this possibility (Warm, Howe, Fishbein, Dember, & Sprague, 1984). Thus, research is needed to further explore how the various forms of social facilitation affect vigilance and to extend these findings to other types of vigilance tasks, such as successive, cognitive-based vigilance tasks.

It was hypothesized that participants who completed the vigil in the presence of a confederate coactor would achieve better performance than those who completed the vigil alone, especially in relation to the overall proportion of false alarms (Claypoole & Szalma, 2017). Additionally, it was also hypothesized that those in the presence of an independent (confederate) coactor would report higher levels of perceived workload and stress than those who completed the vigil alone. Previous research on social facilitation has indicated that social presence is arousing (Cottrell, 1972; Zajonc, 1965) and that some level of stress should be experienced (Shaver & Liebling, 1976). However, authors of the few studies on perceived workload and stress in relation to social presence and vigilance task performance specifically (Claypoole & Szalma, 2017; Funke et al., 2016) have not observed this effect. For instance, Claypoole and Szalma (2017) found no significant differences in either workload or stress, and Funke et al. (2016) reported significant differences only for distress, such that those who completed the task with a coactor found the task less distressing.

## METHOD

### Participants

In total, performance data from 100 participants (68 females) were collected. All participants were undergraduates recruited through the SONA psychology experiment Web site at the University of Central Florida. The proportion of men and women in the sample was representative of the overall gender proportion of subjects in the participant pool at the university where the

data were collected. All participation was on a completely voluntary basis; however, participants did receive course credit for completing the study. This research complied with the American Psychological Association Code of Ethics and was approved by the Institutional Review Board at the University of Central Florida. Informed consent was obtained from each participant. Average age for participants was 20.29 ( $SD = 3.18$ ), with a range from 18 to 37 years.

### Conditions

There were two experimental conditions in this study, a control condition and a coacting condition. In the control condition, each participant completed the experiment alone in the experimental room. This condition was a true control as there was no form of social presence in any part of the experiment (i.e., pretask questionnaires, vigil, and posttask questionnaires; Claypoole & Szalma, 2017).

In the coacting condition, when the participants arrived at the laboratory, they were told that up to two people could complete the experiment at a time and that the researchers were currently waiting on the second participant (who was actually a confederate) to arrive. The participant was then told that they could begin the first part of the experiment while they were waiting on the second participant to arrive; they were then brought to the experimental room to begin the pretask questionnaires (i.e., demographics, pretask Dundee Stress State Questionnaire [DSSQ]). This procedure was implemented to ensure that the pretask DSSQ was not contaminated by social presence. Once the participant completed the pretask questionnaires, the second participant (a confederate) was also brought into the experimental room to complete the vigil. The researcher then went over the instructions and example stimuli and answered any questions the participants may have had (typically there were none).

Before the vigil began, the researcher told the participants,

This experiment requires two participants to complete. Although there are two of you present, your performance will be evaluated independently. Your performance, on

the same task, will not be aggregated or combined, nor will you be aware of each other's performance on the task. As we told you on the informed consent form, your responses will be anonymous and confidential. We simply just need two people to complete the task.

These instructions were included in order to minimize the possibility of competitiveness. During the vigil, the confederate was instructed to infrequently respond at random intervals during the experiment. When the vigil was completed, the participants were then instructed to complete the posttask questionnaires using the same computer on which they completed the pretask questionnaires. This instruction left each participant in the experimental room to complete the questionnaires alone to reduce any confounds (Claypoole & Szalma, 2017) and provided a realistic explanation as to why the confederate was leaving the experimental room. This instruction did not require the participant to change rooms or computers. The participants completed all facets of the experiment on the same computer. Additionally, it is important to note that the setup of the experimental room included partitions between the two computers so that the participants could not see one another throughout the task.

### **Vigilance Task**

The vigilance task utilized in the present experiment was adapted from Warm, Fishbein, Howe, and Kindell (1976; also cited in Warm & Jerison, 1984). The participants were required to monitor a display of two-digit numbers and to respond when a critical signal appeared on the screen. A critical signal occurred when the difference between the two digits was either 0 or  $\pm 1$ . For instance, 43, 77, and 01 were all critical signals, whereas 73, 06, and 39 were not. Each stimulus was presented for 1,000 ms and was followed by an interstimulus interval (ISI; a blank screen) that lasted 1,500 ms, for a stimulus duration of 2,500 ms with an event rate of 24 events per minute (signal probability = 0.035). The participants were instructed to respond by pressing the space bar when a critical signal was presented. They were allowed to

respond at any time during the 2,500 ms that the stimulus and the ISI were on screen. In the 24-min vigilance task, there were five critical signals presented in each 6-min period of watch, for a total of 20 critical signals across the four periods. The timing of the presentations of the five critical signals was randomized during each period, but the selected times were held constant across participants.

### **Measures**

*NASA Task Load Index (NASA-TLX; Hart, 2006; Hart & Staveland, 1988)*. Perceived mental workload was measured by a computerized version of the NASA-TLX administered after the vigil. The standard NASA-TLX procedure was used, in which participants first provided ratings on each of the six subscales and then judged the relative importance of each subscale via pairwise comparisons. These ratings were used to compute a global workload score that was a weighted average of the six subscale ratings. Traditional patterns of perceived workload related to vigilance indicate that mental demand and frustration are the strongest contributors to global workload (Warm et al., 2008).

*DSSQ (Matthews et al., 2002; Matthews, Szalma, Panganiban, Neubauer, & Warm, 2013)*. Perceived stress was measured both prior to and after the vigil. The DSSQ consists of 11 scales that comprise three broad secondary factors: task engagement, distress, and worry. These factors reflect the cognitive, affective, and motivational/energetic dimensions of stress (Matthews et al., 1999, 2002, 2013). In most vigilance experiments, task engagement and worry decrease and distress increases (relative to pretask state) as a function of the task itself (Warm et al., 2008).

### **Procedure**

Participants arrived at the laboratory and were asked by the researchers to show their student identification and to remove any timepieces and cellular devices. Participants were assigned at random to one of the two experimental conditions. In both conditions, participants completed a set of questionnaires (i.e., demographics questionnaire, pretask DSSQ, in that order) prior to the vigil and coacting manipulation (if

they were assigned to that experimental condition). After the questionnaires were completed, the confederate entered the experimental room and was seated at the second computer station (coacting condition only). Next, the researcher reviewed the instructions and example stimuli with the participant and confederate and answered any questions before exiting the room to allow the participant and confederate to complete the vigil. Example stimuli were presented and a 5-min practice vigil was provided in order to familiarize participants with the task. No feedback was provided during the practice session, and there were no performance criteria established for participants to begin the full experiment. Immediately after the practice task, the participants began the 24-min vigil. After the vigilance task was completed, the confederate left the room (coacting condition only) and the posttask DSSQ and NASA-TLX were administered (in that order). The entire duration of the experiment was approximately 50 min.

## RESULTS

### Statistical Analyses

Each measure of performance was analyzed by a 2 (condition)  $\times$  4 (period) mixed ANOVA, with repeated measures on the second factor. Significant Condition  $\times$  Period interactions were further analyzed by testing the simple effects of period within condition. The dependent measures of interest related to performance included hits, false alarms, median response time, and nonparametric indices of sensitivity and response bias. Median response time was reported as it is less susceptible to the influence of extreme scores for individuals within each period (Myers, Well, & Lorch, 2010). The proportions of correct detections and false alarms were used to compute nonparametric indices of sensitivity ( $A'$ ) and response bias ( $\beta''_D$ ; MacMillan & Creelman, 2005) to account for the potential of non-normality in the underlying data decision space distribution (Craig, 1979). In most cases, sphericity was violated; thus a Huynh-Feldt epsilon statistic was used to correct for these violations of sphericity.

Additionally, measures of perceived workload (i.e., NASA-TLX) and stress (i.e., DSSQ)

were analyzed. The NASA-TLX was analyzed by a one-way ANOVA. The DSSQ was analyzed by a 2 (Condition)  $\times$  2 (phase) mixed ANOVA, with repeated measures on the second factor. The scores were calculated by  $Z = (\text{score means}) - (\text{normative means}) / (\text{normative standard deviation})$  for each of the 11 primary scales, and the  $z$  scores were used to compute factor scores for task engagement, distress, and worry (Matthews et al., 1999, 2002). There were 100 participants across both conditions: control (50; 32 females) and coacting (50; 36 females).

### Hits

The proportion of hits significantly decreased across both conditions as a function of period of watch,  $F(3, 294) = 50.541, p < .001, \eta^2_p = .340, \epsilon = .96$ . There was a statistically significant interaction between condition and period of watch,  $F(3, 294) = 2.823, p = .039, \eta^2_p = .028, \epsilon = .96$ . Tests of the simple effects of period within each condition indicated a significant decline in detections with period on watch. As shown in Figure 1, this decline was steeper early on the watch for participants in the control condition relative to those in the coacting condition. However, there was no statistically significant difference between conditions for the overall proportion of hits,  $F(1, 98) = .245, p = .622, \eta^2_p = .002$ .

### False Alarms

The proportion of false alarms decreased significantly across both experimental conditions as a function of period of watch,  $F(3, 294) = 4.234, p = .006, \eta^2_p = .041, \epsilon = .36$ , which is typical of traditional vigilance experiments (Warm et al., 2008). The interaction between condition and period was not statistically significant,  $F(3, 294) = 2.258, p = .082, \eta^2_p = .023, \epsilon = .36$ , indicating that both conditions experienced a similar decrease in false alarms as a function of period of watch. The results also indicated a significant decline across conditions in the proportion of false alarms,  $F(1, 98) = 5.278, p = .024, \eta^2_p = .051$  (see Figure 2). These results indicate that those who completed the vigil in the presence of a coactor committed significantly fewer false alarms ( $M = .005, SE = .005$ ) than those who

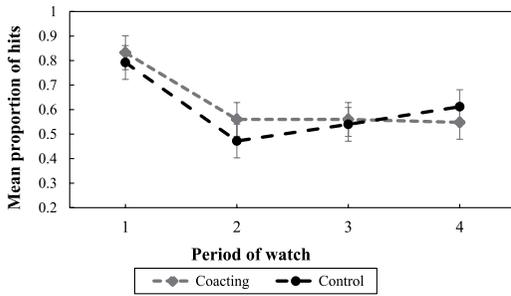


Figure 1. The proportion of hits as a function of period of watch and experimental condition. Error bars are standard errors.

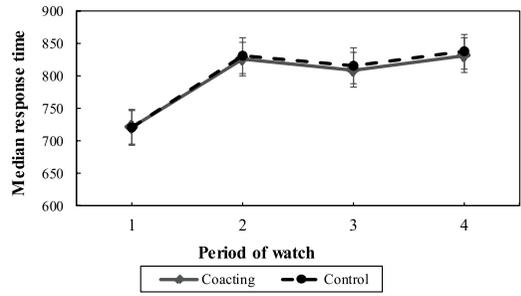


Figure 3. Median response time as a function of period of watch and experimental condition. Error bars are standard errors.

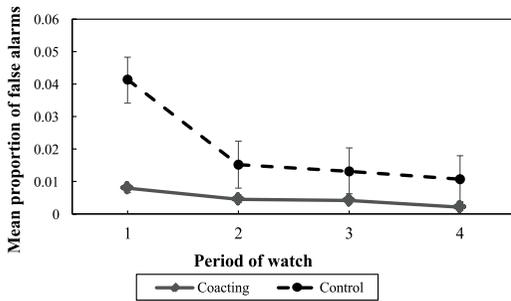


Figure 2. The proportion of false alarms as a function of period of watch and experimental condition. Error bars are standard errors.

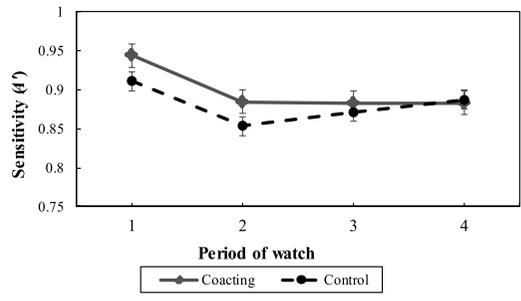


Figure 4. Sensitivity ( $A'$ ) as a function of period of watch and experimental condition. Error bars are standard errors.

completed the vigil alone ( $M = .020, SE = .006, d = .46$ ).

**Response Time**

Median response time increased significantly across both experimental conditions as a function of period of watch,  $F(3, 261) = 49.670, p < .01, \eta^2_p = .363, \epsilon = .92$ . The interaction between condition and period was not statistically significant,  $F(3, 261) = .602, p = .614, \eta^2_p = .007, \epsilon = .92$ , and there were no significant differences between conditions for median response time,  $F(1, 99) = .501, p = .481, \eta^2_p = .005$  (see Figure 3).

**Sensitivity ( $A'$ )**

Sensitivity significantly decreased across both conditions as a function of period of watch,  $F(3, 294) = 18.180, p < .001, \eta^2_p = .156, \epsilon = .76$ . The results did not indicate a statistically significant interaction between condition and sensitivity,

$F(3, 294) = 2.077, p = .103, \eta^2_p = .021, \epsilon = .76$ , indicating that both conditions experienced a similar decrease in sensitivity as a function of period of watch. There were no significant differences across conditions in sensitivity,  $F(1, 98) = 1.932, p = .168, \eta^2_p = .019$  (see Figure 4).

**Response Bias ( $\beta_p$ )**

Response bias increased significantly as a function of period of watch,  $F(3, 294) = 21.635, p < .001, \eta^2_p = .181, \epsilon = .47$ . However, there was not a statistically significant interaction between condition and response bias,  $F(3, 294) = 3.172, p = .062, \eta^2_p = .031, \epsilon = .47$ . The results indicated a significant difference between conditions in response bias,  $F(1, 98) = 4.987, p = .028, \eta^2_p = .048$  (see Figure 5). Participants in the coacting condition ( $M = .949, SE = .005$ ) were significantly more conservative than those in the control condition ( $M = .899, SE = .017, d = .45$ ).

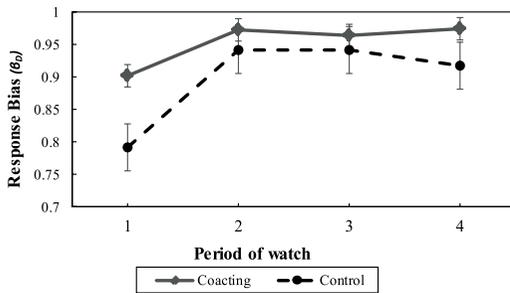


Figure 5. Response bias ( $\beta_D$ ) as a function of period of watch and experimental condition. Error bars are standard errors.

### Perceived Workload (NASA-TLX)

The results indicated a significant effect of condition for global workload,  $F(1, 98) = 11.266, p = .001, \eta_p^2 = .103$ ; temporal demand,  $F(1, 98) = 4.880, p = .029, \eta_p^2 = .047$ ; effort,  $F(1, 98) = 6.148, p = .015, \eta_p^2 = .059$ ; and frustration,  $F(1, 98) = 4.430, p = .038, \eta_p^2 = .043$ . For all measures of the NASA-TLX, those who completed the vigil alone reported higher workload scores than those who completed the vigil in the presence of a coactor, indicating that a coactor may reduce perceived workload. In addition, across both conditions, mental demand and effort were the greatest contributors to workload. A 2 (condition)  $\times$  6 (NASA-TLX scale) mixed ANOVA confirmed that this pattern was consistent across conditions, as the Condition by NASA-TLX Scale interaction was not significant ( $p = .202, \eta_p^2 = .008$ ). The means and standard errors for the NASA-TLX can be found in Table 1.

### Perceived Stress (DSSQ)

Task engagement significantly decreased across both conditions as a function of the vigil,  $F(1, 98) = 68.849, p < .001, \eta_p^2 = .413$ . However, there were no significant effects for condition,  $F(1, 98) = .912, p = .342, \eta_p^2 = .009$ , or for the interaction between condition and task engagement,  $F(1, 98) = .060, p = .808, \eta_p^2 = .001$ .

Distress significantly decreased across both conditions as a function of the vigil,  $F(1, 98) = 81.241, p < .001, \eta_p^2 = .453$ . However, there were no significant effects for condition,  $F(1,$

$98) = .146, p = .703, \eta_p^2 = .001$ , or for the interaction between condition and distress,  $F(1, 98) = .048, p = .826, \eta_p^2 < .001$ .

Worry significantly decreased across both conditions as a function of the vigil,  $F(1, 98) = 40.994, p < .001, \eta_p^2 = .295$ . However, there were no significant effects for condition,  $F(1, 98) = .3620, p = .060, \eta_p^2 = .036$ , or for the interaction between condition and worry,  $F(1, 98) = 1.474, p = .228, \eta_p^2 = .015$ . See Figure 6 for a pictorial representation of the pre- and postvigil scores for task engagement, distress, and worry.

## DISCUSSION

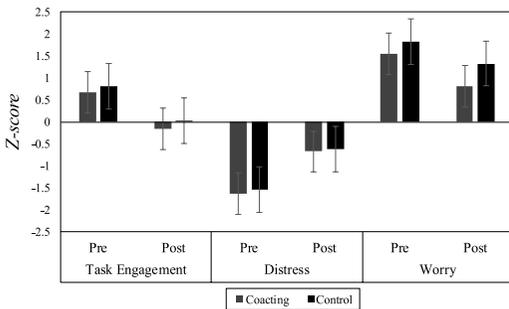
The results indicate that the performance decrements observed in the present experiment were consistent with those observed in previous research (Warm et al., 2008), such that the proportions of hits and false alarms decreased and median response time increased as a function of period of watch. In regard to performance, the presence of a coactor had its strongest effects on the proportion of false alarms, such that those who completed the vigil in the presence of a coactor committed significantly fewer false alarms than those who completed the vigil alone. This finding is in line with previous research regarding other methods of social facilitation and vigilance (Claypoole & Szalma, 2017). However, research on the potential performance effects of coacting specifically has shown improvements for correct detections, such that participants who worked as independent pairs correctly detected more critical signals than participants who completed the task alone (Funke et al., 2016). In the present study, coactor presence did not have a main effect on correct detections, but participants who performed the task in the presence of a coactor did show a smaller decline in detections over periods.

The inconsistency across the two studies may be best explained by the analytic techniques that were utilized in each study. For instance, Funke et al. (2016) utilized a “parallel” decision rule (p. 918), which credits the coacting group with a successful detection if either member of the group responds to the presentation of a critical signal. Only when this parallel decision rule was applied did differences in group performance

**TABLE 1:** Means and Standard Deviations of NASA Task Load Index Subscales Across Conditions (N = 100)

Condition	Global Workload		Mental Demand		Physical Demand		Temporal Demand		Performance		Effort		Frustration	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
CoA (N = 50)	51.13	16.99	56.40	28.45	23.20	22.08	48.10	21.57	39.80	22.25	58.80	27.53	35.30	27.08
Control (N = 50)	61.55	13.90	66.50	23.78	24.80	22.36	57.50	20.98	47.30	23.61	70.70	19.85	47.70	31.66
Total (N = 100)	56.34	16.31	61.45	26.57	24.00	22.12	52.80	21.69	43.55	23.13	64.75	24.61	41.50	29.96

Note. CoA = Coacting.



*Figure 6.* Perceived stress as a function of Dundee Stress State Questionnaire scale and experimental condition. Error bars are standard error.

emerge. Essentially, the individual performance of any observer, regardless of performing solo or in a coacting group, was equivalent; it was only through the specific scoring method applied that coacting groups achieved a higher rate of detections relative to solo observers. In the present study, because the coactor was a confederate, the use of a parallel decision rule could not be applied. Therefore, when comparing the averages of individual performance, the present data align quite well with that of Funke et al., at least in terms of correct detections.

Additionally, Funke et al. (2016) utilized a sensory vigilance task in which participants had to detect if the flight path of an unmanned aerial vehicle was facing an inappropriate direction and would result in collision. Their results indicated that participants who were in a dyadic group correctly detected approximately 82% of the critical signals and did not experience a performance decrement, whereas those who completed the sensory vigil alone correctly detected approximately 57% of critical signals and also

did not experience a performance decrement (Funke et al., 2016). In the present cognitive vigil, participants who completed the vigil in the presence of a coactor correctly detected approximately 83% of critical signals in Period 1, but performance declined to approximately 54% of correct detections in Period 4. Similarly, those who completed the vigil alone went from approximately 79% in Period 1 to 61% in Period 4. So although previous research on the performance differences in cognitive and sensory vigils has suggested that performance efficiency tends to remain stable in cognitive tasks (Deaton & Parasuraman, 1993; Dember et al., 1984; Warm et al., 1984), the opposite trend has been observed in these two studies, such that Funke et al.’s sensory performance tended to remain stable over time, whereas the present cognitive task indicated a performance decrement. As such, the differences between cognitive and sensory vigils should be further investigated to determine the conditions in which these two task types show a performance decrement.

To date, only one recent experiment has provided signal detection theory analyses related to the effects of social facilitation and vigilance task performance (Claypoole & Szalma, 2017; but see Kushnir & Duncan, 1978). Claypoole and Szalma (2017) observed that participants who completed the vigil under some type of social presence (i.e., mere presence or evaluative presence) were more sensitive and more conservative than those who completed the vigil alone. The present results suggest that participants who completed the vigil in the presence of a coactor were also more conservative than those who completed the vigil alone and that they reached this level of conservatism earlier in the

vigil. However, in this study, the experimental conditions did not differ significantly in sensitivity. Interestingly, Kushnir and Duncan (1978) have suggested that social facilitation (in terms of audience presence) should affect only sensitivity and not response bias. Kushnir and Duncan suggested that the presence of an observer affected only the ability of participants to discriminate signals from nonsignals by impairing attention and concentration. However, the performance and workload results from the present study seem to contradict that assertion. Clearly, more research into the effects of social facilitation on sensitivity and response bias are needed, as the results across these three studies are inconsistent.

Surprisingly, the hypotheses related to perceived workload and stress were not supported. Workload was significantly *lower* for those who completed the vigil in the presence of a coactor, compared with those who completed the task alone. Specifically, global workload, temporal demand, and frustration were all significantly lower for those in the coaching condition. Although only a few studies have reported the effects of social facilitation on workload, this finding is the first of its kind, as previous research has demonstrated no significant effects on workload (Claypoole & Szalma, 2017; Funke et al., 2016). This surprising result suggests that the use of coactors may improve performance while reducing workload, an instance of performance–workload association that may reflect strategy shifts or increased skills that result in fewer resources being required to perform the task (Hancock, 1996; Yeh & Wickens, 1988).

Although the results indicate that the vigil itself was stressful (i.e., task engagement decreased and distress increased as a function of the task itself) and are consistent with typical stress findings associated with vigilance (Warm et al., 2008), there were no significant differences between those in the coaching condition and those in the control condition. Again, few studies have reported perceived stress in relation to social facilitation and vigilance. The two that have (i.e., Claypoole & Szalma, 2017; Funke et al., 2016) reported that coaching decreases distress (Funke et al., 2016) and that social facilitation (mere presence and evaluative presence)

increases task engagement (full data set only; Claypoole & Szalma, 2017).

Funke et al. (2016) attribute their workload and (specifically) stress findings to perceptions of companionship and backup behavior (p. 923). Anecdotally, our participants would try to engage in commiseration with the confederate, typically in the form of complaining about how boring they found the task. Although the confederates were instructed to not engage with the participants, this attempted commiseration (and subsequent lack of disagreement from the confederate) may have led to a decrease in perceived workload. However, because the instructions between the two experiments were vastly different (i.e., Funke et al., 2016, incorporated teamwork), it is also possible that independent coaching (as compared with interdependent coaching) results in different patterning of workload and stress.

Taken together, the effects of social facilitation on vigilance task stress are unclear at best. However, the combined findings for perceived workload and stress are potentially a new and promising avenue of research designed to improve vigilance performance without the typical associated costs of increased workload and stress. Although the results of two studies that specifically utilize coaching as a means of enhancing detection performance are insufficient to make bold claims that fly in the face of decades of vigilance research, this new method of improving vigilance certainly warrants further and more robust investigation.

## CONCLUSION

We sought to further examine the potential effects of a coactor on vigilance performance. The results indicate that using social facilitation techniques, such as coaching, improved performance (i.e., fewer false alarms) and decreased perceived workload. Authors of future research should extend the present findings to other forms of social facilitation (Claypoole & Szalma, 2017) and further examine vigilance task performance in different social contexts in order to provide additional means of improving vigilance. The findings from the relatively limited research on social facilitation and vigilance suggest that the use of social presence, or coaching,

may be an avenue for organizations to consider utilizing due to the relative cost-effectiveness and easy implementation (Claypoole & Szalma, 2017).

### AUTHORS' NOTE

A small percentage of the data presented in this manuscript was also used in an unpublished doctoral dissertation.

### KEY POINTS

- Of interest to human factors psychologists is the use of social presence to mitigate the vigilance decrement.
- In the present study, the effects of an independent coactor on vigilance task performance were examined.
- The results indicate that performance was facilitated but only for the proportion of false alarms.
- Most notably, perceived workload was decreased for those completing the vigil in the presence of an independent coactor, and perceived stress was not affected.
- The results of the present study indicate that organizations may wish to implement independent coactors in order to improve performance and lower perceived workload.

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