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Effects of the Use of Social Network Sites on Task Performance: Toward a Sustainable Performance in a Distracting Work Environment

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Abstract: As the use of social network sites (SNS) has become increasingly prevalent, its effect on sustainable performance has received much attention. The existing literature has taken either a positive or negative view of SNS, arguing that it either decreases performance by taking time and effort away from work, or increases performance by providing social benefits for enhancing performance. In contrast, this experimental study, investigates how SNS use can disturb or enhance the performance of different types of tasks differently, thus influencing the sustainability of task performance. Based on distraction-conflict theory, this study distinguishes between simple and complex tasks, examines the role of SNS, and analyzes data including electroencephalography data captured by a brain-computer interface. The results show that task performance can be sustainable such that SNS use positively influences performance when participants are engaged in a simple task and influences performance neither positively nor negatively when participants are engaged in a complex task. The study finds the former result is attributable to the positive effect of the psychological arousal induced by SNS use and the latter result to the negative effect of the psychological arousal offsetting the positive effect of reduced stress resulting from SNS use.

Keywords: sustainable performance; task performance; SNS use; EEG; distraction-conflict theory; break; arousal; stress

1. Introduction

The use of social network sites (SNS) has become a mundane activity for most people. Facebook alone had more than 1.86 billion monthly active users in 2016, 1.23 billion use it daily, and almost 94% of daily active users (1.15 billion) use it through mobile devices [1]. Given the prevalence of mobile support, people use SNS without time and space limitations, and SNS use has become rather constant.

One of the controversial issues regarding this perpetual SNS use is the relationship between SNS use and performance: is SNS use helpful or harmful to the sustainability of an individual's performance? Many people believe that SNS use diminishes performance. In terms of learning performance, SNS use decreases it by reducing the time and energy available for learning [2], leading some professors to ban all laptop use in the classroom to prevent SNS use during lectures [3]. Most organizations also consider SNS use a distraction that impairs employees' task performance. In a survey of 1400 Chief Information Officers of U.S. companies with 100 or more employees, 54% responded that their companies prohibit SNS use completely, 19% authorize it for business purposes only, 16% permit it for limited personal use, and only 10% allow it for any type of personal use [4]. As this result shows, the majority share the view that SNS use while working diverts employees' attention away from their tasks, and thus should be limited to work-related purposes, if allowed at all.

However, completely banning SNS use during work or limiting SNS use to only work-related purposes seems neither possible nor effective. The prevalence of mobile devices does not require employees to have access to a company-controlled network to use SNS. Most people are already chronically connected to SNS, spending 1 h and 49 min per day on average on SNS, constituting 28% of their Internet use [5]. Moreover, in a survey of 1060 companies that have adopted corporate SNS for business purposes, 60% responded that SNS had the positive effect of improving organizational performance but only when its use was not limited to work-relevant matters and embraced all kinds of social interaction [6].

Researchers who have focused on the social benefits rather than the harmful distractions of SNS suggest that SNS use can increase overall performance. For example, studies have found that it can encourage cooperation [7], interaction [8], knowledge generation and sharing [9], strengthened relationships among members [10], enhanced psychological well-being [11], and increased emotional capital of an organization [6] and thereby enhance performance.

As such research implies, the effect of SNS use on performance can be more complex than simply negative or positive. While SNS use can be a distraction that takes attention and resources away from the primary task, its social aspects can simultaneously facilitate a positive effect and result in increased performance. Therefore, understanding the relationship between SNS use and sustainable performance requires a more integrated and granulated view that can explain when and how SNS use can diminish or enhance task performance. Most research, however, is not designed to investigate the effect of SNS use on performance during the completion of a task, and is thus limited in aiding understanding of how the effect of distraction and social aspects induced by SNS use simultaneously operate on task performance.

This study, therefore, adopts distraction–conflict theory [12,13], which suggests a certain distraction can work positively on simple task performance while the same distraction can operate negatively on complex task performance. This theory can be useful and effective in explaining how the SNS use during the completion of work tasks can operate both negatively and positively on the sustainability of task performance. More specifically, the study tries to answer two questions: (1) Does such SNS use increase or decrease task performance? (2) What is the underlying mechanism of SNS use that either increases or decreases task performance? To answer these questions, this study uses an experimental method and analyzes responses gathered by a self-reported scale and electroencephalography (EEG) data gained from a Brain–Computer Interface (BCI) device.

2. Literature Review: Effect of SNS Use on Performance

Research has yielded conflicting findings about the relationship between SNS use and performance. This is because most studies on SNS use have focused on just one or the other of two critical aspects of people's engagement leading to performance: (1) the time and effort they invest in a task, and (2) social aspects of the task, such as their interaction with others in the task environment [14]. Research that focuses on the first considers SNS use as a distraction and views the time and energy spent on SNS use as reducing those that should be devoted on performing a given task, thus suggesting that SNS use decreases task performance. In contrast, the research that focuses on the second values the social aspects of SNS that can leverage task performance directly and indirectly, thus arguing that SNS use improves performance.

2.1. The Negative Effect of SNS Use on Performance

Regarding SNS use and the sustainability of work performance in an organization, researchers share the view that SNS use reduces the time that employees are supposed to devote to work, thus decreasing productivity, which is significantly constrained by limited time resources at work (e.g., [15,16]). For example, Herlle and Astray-Caneda [17], viewed SNS as a distraction from work that reduces work input such as completing jobs in timely manner and staying focused on job activities during work time, and, consequently work outcomes, such as recognition and advancement opportunities. They argued that SNS should be managed and controlled through organizational means, such as training programs that teach organizational policies about SNS use and their responsibility regarding the compliance with those policies and emphasize job input and output balance.

Research about the relationship between SNS use and the sustainability of academic performance shows similar findings. While some researchers found no relationship between Facebook use and academic performance (e.g., [2,18,19]), others found a negative relationship between them. Junco [20] and Kirschner and Karpinski [2] demonstrated that time spent on Facebook was strongly negatively related to overall GPA, as time spent on Facebook was negatively related to time spent preparing for class. Frein, et al. [21] showed that high-use Facebook users had significantly lower scores on a free recall test than did low-use Facebook users. In an experiment by Wood et al. [22], participants in a Facebook use condition performed more poorly than those in a paper-and-pencil use condition. Gupta and Irwin [23] found that when students received Facebook interruptions, they showed lower lecture comprehension.

2.2. The Positive Effect of SNS Use on Performance

On the other hand, many researchers have found the positive effect of SNS use on performance, focusing on its social functions. Regarding work performance, many believe that SNS as a social technology can leverage the value of an organizational social network by enabling employees to collaborate, communicate better, transfer knowledge, and reach out to experts whom they have never encountered in a physical space to seek information (e.g., [24,25]). While examining those views, researchers have found rather various results and diverse reasons in explaining those because the social benefits of SNS can also vary. For example, Charoensukmongkol [26] argued that SNS use can enhance perceived social support and found that intense use of SNS increased employees' perceived level of job performance. In a study of 1799 employees in the insurance industry, Leftheriotis and Giannakos [27] found that a high social media usage group perceived their own work performance as higher than groups with low or medium social media usage. Similarly, some found a positive effect of SNS on performance improvement, but the way it turned out was different from their expectations. For examples, Cao et al. [28], expecting to find that SNS use would enhance software professionals' performance through promoting knowledge transfer and stimulating trust, found that it contributed to increasing work performance only by strengthening trust among employees. Moqbel et al. [29] hypothesized that the intensity of SNS use could directly enhance job performance by improving work-life balance, but found that SNS intensity affected job performance only through job satisfaction.

Diverse reasoning about the positive relationship between SNS use and performance is also indicated regarding academic performance. The findings of Al-rahmi and Othman [30] showed that students' interaction with peers and teachers through SNS enhanced their academic performance directly and through collaborative learning. Yu et al. [31] found that Facebook engagement not only affected performance proficiency positively but also improved it through increasing social acceptance and acculturation. Ainin et al. [32] reported that Facebook usage intensity affected academic performance positively by mediating social acceptance.

2.3. The Effect of SNS as a Distraction and Social Technology on Performance

As a whole, research has clearly shown that SNS use is a distraction from task performance, but SNS are also social technologies that can improve overall performance by providing social benefits to their users. Therefore, this study asks, what if the distraction and social effects of SNS, which appear to be contrasting effects, operate simultaneously? For example, what if a person uses SNS during the completion of a task but is somehow positively affected by the social benefits of SNS? Will the distraction effect still be dominant and decrease task performance? Or will the positive social effects offset the distraction effect and increase overall task performance?

The existing literature, however, does not provide an answer to this question. This is mostly because, first, most findings have not resulted from a research design examining task performance when people are distracted by SNS during the completion of a task, and second, most have not considered how SNS use affects performance differently depending on task type. Some research, for example, has simply compared the performance of SNS users to that of non-SNS users (e.g., [21,27]). Some has used a retrospective method, asking people to report their SNS usage experience and related it to their final performance (e.g., [30,31]). Others have employed a self-reporting method, asking SNS users to evaluate their own performance and comparing those reports to those of non-SNS users (e.g., [26,27]). Only a few studies have used a task-performing scenario and conducted an experiment. In one study, Gupta and Irwin [23] simulated using SNS and listening to a lecture as concurrent tasks and studied how students allocated their attentional resources between them. They found that the task and SNS use competed for the students' attention and that their attentional resources were allocated toward the source that provided the maximum reward: the participants selected SNS over a low-interest lecture more often than over a high-interest lecture. The view on SNS in this study, however, was limited to another source of multi-tasking distraction rather than a social technology whose impact can be diverse and pervasive in this highly connected era. Similarly, Wood, Zivcakova, Gentile, Archer, De Pasquale and Nosko [22] took the same view, comparing SNS messenger use to other distractions such as emailing and texting.

Therefore, understanding the effect of SNS on performance during the completion of a task in a more consolidated and reconciled manner as both a disturbance or social leverage will provide much more useful insights about the relationship between SNS use and the sustainability of task performance.

3. Theoretical Background and Hypothesis: Distraction–Conflict Theory

It is generally recognized that distractions decrease creativity and performance in jobs that require concentration and creative thinking [33,34]. Distraction is defined as something that directs task performers' attention away from some ongoing activity [12,13]. This divided attention results in attentional conflict among inputs when the distraction is very interesting or hard to ignore and performers cannot attend simultaneously to the required task and the distraction. It then leads to capacity and structural interferences, in which the number of incoming cues interferes with the capacity to handle the task and divided attention to multiple inputs interferes with cognitive processing [35].

Not all distraction, however, is necessarily negative. Social facilitation suggests that distractions caused by the presence of others lead people to be in a heightened state of psychological arousal. This state is called drive as it has the effect of an excitatory state and has power to drive one's behavior [36,37]. This drive operates to enhance dominant responses, the most quickly elicited responses to the stimulus [36]. It suggests that when people are psychologically aroused, they tend to do what they are usually likely to do more strongly. When people are doing a simple task, such as a well-learned routine task, the dominant responses are mostly correct ones that are helpful to execute tasks; thus linked to better performance. However, when people are doing a complex task such as one that is not well-defined, the dominant responses are usually incorrect; thus the execution of dominant responses may lead to deterioration of performance [36].

The current study argues that this type of social facilitation can be provided by SNS use. As Markus [38] showed, the mere presence of others can elevate drive by provoking attentional conflict and can generate social facilitation just as with the specific presence of others. The mere presence of others means that the performer is aware that other people are there, but these other people do not evaluate the performers, give cues, deliver reinforcement, or lend help. Nevertheless, simply being aware of others' presence can distract performers and enhance or impair their performance. SNS can provide a similar presence environment. It creates a feeling of social presence [39,40], which is defined as the extent to which a medium is perceived as sociable, warm, sensitive, personal, or intimate [41], thus increasing psychological arousal. Even though the presence of others in SNS is virtual rather than physical and does not take place in real time, online presence can lead to a feeling of crowding, which suggests insufficient personal space or excessive social contact within one's surrounding [42]. Furthermore, recent studies have extended the sources of social presence from physical human beings to virtual ones induced by technology (e.g., [43–45]). Thus, the following hypothesis is suggested:

Hypothesis 1. *The psychological arousal in a group with SNS use will be higher than in a group with no SNS use.*

Distraction–conflict theory also posits that stress arises during performing a task and operates differently depending on the type of task. Stress is felt when there is a "substantial imbalance between environmental demand and the response capability of the focal organism" [46] (p. 17). When performing a simple task, stress narrows the performer's attention on a task and creates the possible exclusion of irrelevant information [37]. Thus, decreasing the stress level is not an appropriate tactic for increasing performance for a simple task. It is stress induced in a high-demand and high-threat situation that disrupts performance [47]. When people are exposed to a task that is challenging and threatening, stress rises as the anticipation of failure also arises and they try to adjust to the stress physiologically, psychologically, and behaviorally [48]. In this process, task performance is generally diminished since dealing with stress takes resources that can be psychological or physiological and should be allocated to performing tasks [49]. Thus, people fail to sustain their performance level [50]. People who confront a high task load tend to experience more stress and to perform less well than those assigned a low task load [51–53]. Therefore, there has been much effort to decrease task stress when performing complex tasks.

In particular, attention-related research argues that stress increases and task performance deteriorates when people experience directed attention fatigue after performing a task for an extended period [54]. Therefore, research suggests that attention should be moved from a task even for a short period time, and even this short break can help restore attention and reduce stress, thus repairing the impaired performance level. A break means a period of time in which work-relevant tasks are not required or expected [55], and taking it decreases work fatigue and maintains performance level [56]. Trougakos, Beal, Green and Weiss [55] have also shown that respite activities such as socializing during work breaks are effective in increasing positive emotions and decreasing negative emotions. Furthermore, this effect of socializing can operate regardless of whether it provides work-relevant social support that can be helpful in performing a task. When stressful events occur, Cohen and Wills [57] suggest, not only the specific social support given to a person regarding the event but also the existence of social integration—the feeling of being embedded in a larger social network—can have a positive effect on reducing stress and a person's well-being. Therefore, as SNS use fundamentally involves social aspects regardless of active or passive social activities, its use can become a break and, at the same time, an effective means of gaining social integration. In other words, by moving attention away from a task and making people feel others' presence, SNS use can be effective in decreasing stress. Since the effect of decreasing stress improves performance only for complex tasks, the following hypothesis is posited:

Hypothesis 2. *For those performing complex tasks, the stress level will be lower in a group with SNS use than in a group with no SNS use.*

For the performance of simple tasks, given that increased psychological arousal induced by SNS use can increase task performance. Distraction–conflict theory can elaborate how this works [12,13]. People perform better when the beneficial effect of elevated drive generated by distraction outweighs the disruptive effects of distraction. In the case of performing a simple task, the intensity of distraction can actually have a positive effect on task performance [37]. The following hypothesis, therefore, is proposed:

Hypothesis 3. *The performance of a simple task will be higher in a group with SNS use than in a group with no SNS use.*

In the case of complex tasks, however, predicting performance following SNS use is complicated. The effect of psychological arousal increased by SNS use can deteriorate performance of complex tasks, but the effect of reduced stress can promote it. Therefore, this study hypothesizes that those two effects will offset each other, and that SNS use thus will neither increase nor decrease complex task performance overall. Therefore, the following hypothesis is proposed:

Hypothesis 4. *The performance of a complex task by an SNS use group will be indifferent from that of a no SNS use group.*

4. Method

An experiment was conducted. Particularly to capture stress of participants, the electroencephalography (EEG)-based BCI method was used. BCI is a non-invasive technique for recording brain signals using electrodes placed on the scalp to capture electrical activity primarily in the cerebral cortex [58]. The BCI device offers demonstrated usability, reliability, cost effectiveness, and portability. It also involves minimal risk for participants due to its non-invasive way of monitoring their brain signals. Thus, the relative convenience of conducting studies and recruiting participants has increased the adoption of the BCI method in various areas recently (e.g., [59,60]). The particular BCI used for this study is Emotiv EPOC+ wireless headset (Emotiv (https://www.emotiv.com/), San Francisco, CA, USA).

4.1. Experiment Design and Procedure

To ensure that the difference between the SNS use and no SNS use groups was not due to the mere effect of not doing a task, the non-SNS users were divided into two groups, one which took a time of not doing a task (break) but did not use SNS and one which neither used SNS nor had a break. Therefore, a 2 (task complexity: simple task vs. complex task) × 3 (the existence of distraction: SNS use vs. no SNS use (break and no break)) design was employed. Participants were randomly distributed among the resulting six conditions:

(1) Simple task, SNS use
(2) Simple task, no SNS use (break)
(3) Simple task, no SNS use (no break)
(4) Complex task, SNS use
(5) Complex task, no SNS use (break)
(6) Complex task, no SNS use (no break)

In this experimental setting, it was essential to ensure that participants did not have any distractions other than that intended for the study. Therefore, the experiment was conducted in a room in which each participant worked alone. As even the mere presence of an experimenter can be a distraction, all experiment materials, including instructions, task forms, and questionnaires, were given as computer versions. The detailed procedure was as follows. Each participant entered a waiting room and was asked to read the provided task instructions. When the participant was ready, he or she was escorted into an adjoining room and was seated in front of a computer. An experimenter then placed a BCI headset on the participant. After the experimenter confirmed that the headset was worn properly and then left the room, the participant clicked an online task, starting the experiment. When a message announcing the end of the experiment was displayed on the computer screen, the participant was asked to call out to the experimenter. The headset was then removed by the experimenter, and the participant returned to the waiting room and left.

4.2. Task Complexity and Distraction Manipulation

Earley's [61] scheduling task was adopted for the simple and complex tasks, as it is known to be useful in controlling task complexity with the same materials and requires problem-solving efforts. In doing this task, participants were asked to produce five unique schedules, each consisting of five non-redundant classes. Upon starting the task, an online page was displayed with five empty class slots for making a single schedule. By clicking each slot, a participant could see a list of 12 classes, each having at least 10 different sections. Each class section had information consisting of (a) course name; (b) day; and (c) time. For example, "Business Writing [Mon, Wed, Fri] 8:00–8:50 a.m." meant that a business writing course was offered at 8:00–8:50 a.m. on Monday, Wednesday, and Friday, and a participant could choose the class for any one of those days; "Business Writing [Mon] 9:00–10:30 a.m." meant that the course was available at 9:00–10:30 a.m. only on Monday. When one schedule was complete, the participant clicked the "next" button to move to the next schedule.

During this task, participants in both conditions were asked to follow three scheduling rules: (a) each schedule must have five different classes scheduled on the same day; (b) class times within a single schedule must not conflict; and (c) each schedule cannot duplicate another schedule. For participants in the complex task condition, three additional rules were imposed: (a) no two marketing courses (i.e., marketing research, marketing strategy, and consumer behavior) can be scheduled within one hour of each other; (b) if a communication class is selected, the communication practice class should also be included in the schedule and vice versa; and (c) if a course with an introduction class is selected, the same course with a discussion class must also be in the schedule and vice versa.

After finishing the first three schedules, participants in the SNS use group were interrupted and asked to use their Facebook account for about three minutes. The three-minute time span for the duration of SNS use was selected for three reasons. First, the average human attention span for a freely chosen task can range from 5 to 20 min [62]. Second, the experimental design required assigning an equal amount of minutes to the SNS use and no-SNS use and break groups and the experiment had to avoid having the participants in the latter groups becoming overly bored while instructed to refrain from doing anything for that period of time. Third, the aim of this study was to demonstrate that even a short use of SNS can affect task performance. As a result, the duration of SNS use was conservatively chosen as three minutes, which is slightly shorter than the minimum attention span.

Participants in the no-SNS use group who were assigned a break were instead asked to look at the green square displayed on the page and do nothing for about three minutes. The green square was shown for two reasons. First, the ultimate goal of the break was to release attention and looking at green can help to achieve this purpose [63]. Second, by providing clear and specific guidance for this period, participants were prevented from engaging in other attention-requiring activities. After three minutes, they were asked to continue the scheduling and finish the tasks.

Participants in the no-SNS use group without the break condition were not interrupted and instructed to make five course schedules consecutively. All of these instructions were displayed on the computer screen as the experiment progressed.

4.3. Measurements

Three different types of measurement were used—namely, an objective measure, a self-report measure, and an EEG interpretation measure. First, as an objective measure, the clock counter on the computer calculated the time taken for a task. Second, a self-report measure was used to capture the participants' psychological arousal. Third, stress was captured through an EEG interpretation measure provided by Emotiv EPOC+ software. The usefulness of capturing emotions and psychological state through the EPOC+ is widely accepted in the literature (e.g., [64,65]).

4.3.1. Task Performance

Task performance can be measured in two ways: by how accurate the result was and by how long it took. First, for accuracy, each rule violation in scheduling received a penalty score. The analysis of variance (ANOVA) result on this penalty score indicated no differences in accuracy across the six conditions—$F = 0.791$ ($p = 0.557$) for schedule 1, $F = 0.972$ ($p = 0.436$) for schedule 2, $F = 0.706$ ($p = 0.620$) for schedule 3, $F = 1.562$ ($p = 0.172$) for schedule 4, and $F = 0.784$ ($p = 0.562$) for schedule 5—suggesting that scheduling mistakes randomly occurred among participants. Therefore, participants' task performance score was measured by the time (seconds) it took to finish the task. As the time taken for the first scheduling task may include the participants' learning time of becoming accustomed to the online scheduling setting, the time of the first scheduling was likely to be overestimated thus disregarded. Then, the summation of the time taken for the second and third scheduling was used as the performance score before the treatment (*pre-performance*), and that of the fourth and fifth scheduling was used as the performance score after the treatment (*post-performance*).

4.3.2. Psychological Arousal

The measure of psychological arousal was adopted from studies by Bradley and Lang [66] and Mehrabian and Russell [67]. It consists of a set of 12 bipolar adjective pairs (relaxed-stimulated, calm-excited, sluggish-frenzied, dull-jittery, sleepy-wide awake, and unaroused-aroused) that are each rated along a seven-point scale. Participants were asked to choose the rating that best described their current status on each pair.

These questions were asked twice, first before the scheduling task to capture their initial psychological arousal status (*initial-arousal*), then right after SNS use for SNS use groups and right after break for no SNS use-break groups (*treatment-arousal*). Given that the no SNS use-no break groups did not get a break, treatment-arousal was captured only for the SNS use and no SNS use-break conditions. Then the average of the participants' answers to the questions was used as the measure of psychological arousal.

4.3.3. Stress

Stress level was monitored by BCI throughout the experiment. The average of the participants' stress scores for the second and third scheduling was used for *pre-stress*, and that of their scores for the fourth and fifth scheduling was used for *post-stress* for the analysis.

5. Results

5.1. Participants

For the experiment, 252 participants were recruited from a Korean university campus. Participants were restricted to students who use Facebook and were promised 10,000 Korean won (roughly $9) for their participation. For the analysis, the data of 18 participants whose EEG data were not generated due to an unstable BCI connection or who reported no Facebook friends, suggesting their experience could be significantly different from that of other participants, were eliminated. As a result, the data of 234 participants, 114 males and 120 females, aged from 18 to 34 (M = 22.021, SD = 2.189), were used for the analysis. Demographic information regarding the participants is reported in Table 1.

Table 1. Demographic profiles of participants in terms of Facebook use.

Items	Category	Frequency (Percentage)
Average number of Facebook friends	Less than 100	35 (14.96%)
	100–less than 200	46 (19.66%)
	200–less than 300	56 (23.93%)
	300–less than 400	47 (20.09%)
	400–less than 500	23 (9.83%)
	500 or more	27 (11.54%)
Average number of updates per week	Less than once	163 (69.66%)
	Once	52 (22.22%)
	More than once	19 (8.12%)
Average hours of use per week	Less than an hour	19 (8.12%)
	1 h–less than 5 h	114 (48.72%)
	5 h–less than 10 h	53 (22.65%)
	10 h or more	48 (20.51%)

For the SNS use conditions, participants were asked to select all the activities in the list in Table 2 that they did when they were interrupted and asked to use Facebook. Regarding the number of activities, 47 participants answered they did one activity, 22 answered two, nine answered three, two answered four, and one answered all the activities. Table 2 shows the number of participants who answered they did the corresponding activity.

Table 2. The participants' Facebook activities in SNS use conditions.

Activities	The Number of Participants		
	Simple Task	Complex Task	Total
Read timeline	28	22	50
Pressed Like	7	15	22
Examined others' likes and replies in my timeline	8	4	12
Messaged or read messages	3	6	9
Commented to others' postings	4	4	8
Made friends	2	0	2
Other	15	15	30

ANOVA was conducted to ensure that there were no significant demographic differences among six groups in terms of gender ($F = 0.915$ ($p = 0.472$)), age ($F = 1.553$ ($p = 0.175$), M = 22.021, SD = 2.189), the number of Facebook friends ($F = 1.219$ ($p = 0.301$), M = 271.526, SD = 219.374), the average number of updates per week ($F = 1.670$ ($p = 0.143$), M = 0.515, SD = 1.231), and the average hours of Facebook use per week ($F = 0.884$ ($p = 0.492$), M = 6.059, SD = 7.568).

5.2. Manipulation Check of Task Complexity

To ensure that the complexity of the task was manipulated correctly, participants were asked to respond to the difficulty of the task using three questions taken from Earley [61]: "I found this to be a complex task", "This task was mentally demanding", and "this task required a lot of thought and problem solving". A seven-point Likert scale with responses that ranged from "strongly disagree" to "strongly agree" was used for those three questions and the responses were averaged. To eliminate the possible effect of break-taking and SNS use on felt task complexity, participants in those two conditions were asked these questions before the treatment. Participants in the no break condition were asked to answer the questions at the end of the task, as they did not receive the treatment.

A *t*-test for the different task groups and two ANOVAs across the same task groups were conducted (see Table 3 for descriptive statistics). A *t*-test result confirmed the difference in task complexity between the simple task and complex task (t = 3.972 (p = 0.000)). Within the same task type, no differences were found among groups for either the simple task (F = 0.129 (p = 0.971)) or the complex task (F = 0.203 (p = 0.817)), thus suggesting that the complexity of the task was manipulated as intended.

Table 3. Task complexity statistics across groups.

Task Type	**Simple Task (n = 113)**			**Complex Task (n = 121)**		
Condition	**SNS Use**	**No SNS Use**		**SNS Use**	**No SNS Use**	
		Break	**No Break**		**Break**	**No Break**
	(n = 38)	(n = 36)	(n = 39)	(n = 43)	(n = 37)	(n = 41)
Mean (Std. Dev.)	3.825 (1.492)	3.833 (1.367)	3.761 (1.431)	4.395 (1.092)	4.559 (1.274)	4.520 (1.276)
		3.805 (1.420)			4.488 (1.205)	

5.3. Hypotheses Testing

Table 4 shows the descriptive statistics of the scores for each task. Before testing the hypotheses, ANOVA for pre-scores across groups for each type of task was conducted to ensure that the difference in post-scores across groups was due not to the idiosyncratic characteristics of each group but to the treatment effect. If this holds true, the pre-scores should not differ across groups. None of the differences of the pre-scores across groups were statistically significant for the simple task—F = 1.972 (p = 0.144) for initial-arousal, F = 0.398 (p = 0.672) for pre-stress, and F = 0.372 (p = 0.690) for pre-performance—and for the complex task—F = 0.85 (p = 0.919) for initial-arousal, F = 2.678 (p = 0.073) for pre-stress, and F = 0.036 (p = 0.965) for pre-performance. This demonstrates no statistically significant differences in the initial statuses of participants.

Table 4. Descriptive statistics of scores (mean (std. dev.)).

Measure	Scores	Simple Task			Complex Task		
		SNS Use	No SNS Use		SNS Use	No SNS Use	
			Break	No Break		Break	No Break
Arousal	Initial	4.079 (0.669)	3.866 (0.671)	3.769 (0.750)	4.012 (0.781)	3.950 (0.658)	3.967 (0.619)
	Treatment	3.754 (0.744)	3.065 (0.784)		3.632 (0.710)	3.239 (0.983)	
Comparison of treatment to SNS use			F = 12.763 (p = 0.001)			F = 4.437 (p = 0.038)	
Stress	Pre	0.533 (0.189)	0.511 (0.147)	0.503 (0.109)	0.538 (0.180)	0.487 (0.111)	0.561 (0.127)
	Post	0.468 (0.171)	0.429 (0.133)	0.493 (0.134)	0.444 (0.145)	0.426 (0.135)	0.539 (0.146)
	Paired-t (sig.)	t = 1.759 (p = 0.087)	t = 4.301 (p = 0.000)	t = 0.502 (p = 0.618)	t = 3.121 (p = 0.003)	t = 2.692 (p = 0.011)	t = 1.568 (p = 0.125)
Comparison of post-score to that of SNS use			F = 0.844 (p = 0.361)	F = 1.055 (p = 0.308)		F = 0.303 (p = 0.584)	F = 8.850 (p = 0.004)
Performance	Pre	258.590 (117.626)	275.870 (123.641)	283.315 (142.883)	353.998 (167.004)	364.696 (176.046)	357.985 (194.705)
	Post	195.580 (71.670)	254.685 (136.009)	236.449 (115.006)	291.126 (138.616)	283.364 (109.580)	300.850 (145.651)
	Paired-t (sig.)	t = 3.421 (p = 0.002)	t = 1.039 (p = 0.306)	t = 2.622 (p = 0.013)	t = 2.125 (p = 0.040)	t = 3.294 (p = 0.002)	t = 1.947 (p = 0.059)
Comparison of post-score to that of SNS use			F = 6.137 (p = 0.016)	F = 4.568 (p = 0.036)		F = 0.078 (p = 0.781)	F = 0.070 (p = 0.792)

The hypotheses comparing post-scores across groups were tested using one-way analyses of covariance (ANCOVA). According to distraction-conflict theory, psychological arousal is the critical factor that affects performance. As participants can be aroused by the interaction with the administrator at the beginning of the experiment and by the artificial nature of experiment setting, their initial psychological arousal scores were used as the covariate in ANCOVA. The test results are presented in Table 5 and illustrated in Figure 1.

As the no SNS use and no-break group did not have their psychological arousal measured between pre-treatment scheduling and post-treatment scheduling, only the comparison between the SNS use group and break group was made. As expected, the SNS use group shows higher psychological arousal scores than the simple break group for both types of task, supporting Hypothesis 1. The result is illustrated in Figure 1.

Table 5. The results of hypotheses testing.

Comparisons	Task	Comparing Conditions	F (sig.)	Hypothesis Results
Treatment-psychological arousal	Simple Complex	SNS use vs. break SNS use vs. break	12.763 (p = 0.001) 4.437 (p = 0.038)	H1/Supported
Post-stress	Simple	SNS use vs. break SNS use vs. no break	0.844 (p = 0.361) 1.055 (p = 0.308)	
	Complex	SNS use vs. break SNS use vs. no break	0.303 (p = 0.584) 8.850 (p = 0.004)	H2/Not supported
Post-performance	Simple	SNS use vs. break SNS use vs. no break	6.137 (p = 0.016) 4.568 (p = 0.036)	H3/Supported
	Complex	SNS use vs. break SNS use vs. no break	0.078 (p = 0.781) 0.070 (p = 0.792)	H4/Supported

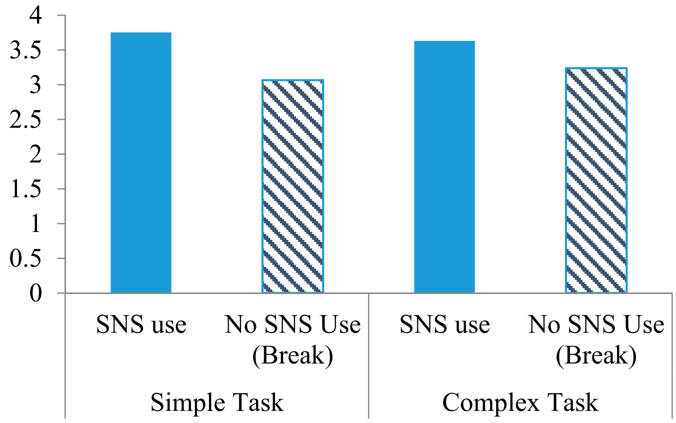

Figure 1. Psychological arousal for treatment groups.

Figure 2 indicates pre- and post-stress levels of each group. Post-stress levels of all groups seem to be decreased when compared to their pre-stress levels, but this decrease is statistically significant in only three groups: (1) simple task, no SNS use-break group; (2) complex task, no SNS use-break group; and (3) complex task, SNS use group. The dotted lines represent the groups whose change in stress level was not statistically significant.

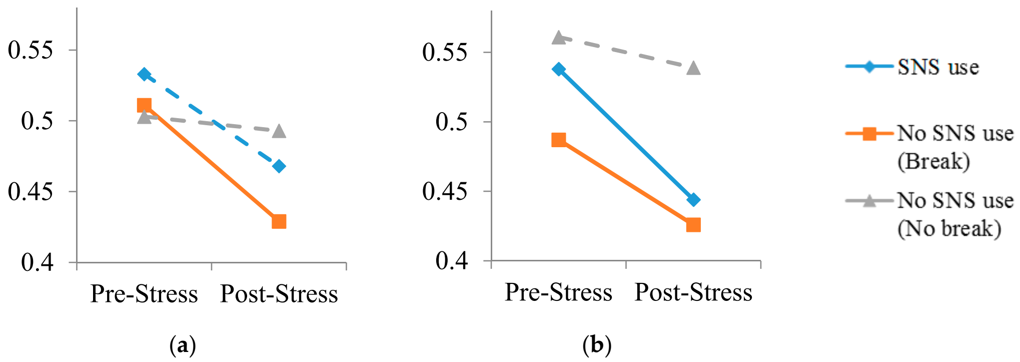

Figure 2. Comparison of stress levels. (**a**) Simple Task Scheduling; (**b**) Complex Task Scheduling.

Regarding stress, it was expected that SNS use would not cause a difference in stress level in participants when performing the simple task. The results indicate that the stress level of the SNS use group was not different from that of the simple break and no break groups. When performing complex task, however, the stress level of the SNS use group was lower than that of the no break group but no different from that of the simple break group. Thus, Hypothesis 2 is overall not supported.

For the performance of the simple task, the performance of the SNS use group was significantly better than those of the no SNS use groups, thereby supporting Hypothesis 3. On the contrary, for the performance of the complex task, the performance of the SNS use group was not statistically different from that of the no SNS use groups. Therefore, Hypothesis 4 is also supported. Figure 3 summarizes pre- and post-performances of each group. The performance of all groups improved as time went by. However, the performance improvements of no SNS use and break group on simple task and the no SNS use and no break group on complex task were not statistically significant (see dotted lines in Figure 3).

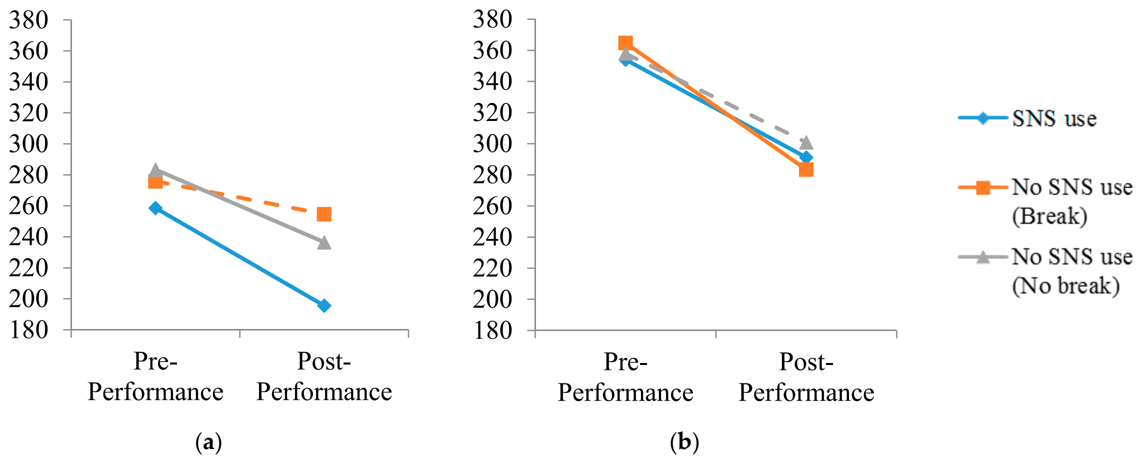

Figure 3. Comparison of performance. (**a**) Simple Task Scheduling; (**b**) Complex Task Scheduling.

5.4. Additional Analysis

To further scrutinize how this performance difference occurred, the time taken for each scheduling was also investigated. Performance changes for each scheduling are summarized in Table 6 and illustrated in Figure 4.

Table 6. The time taken for each scheduling (mean (std. dev.)).

		Scheduling			
Task	Condition	2nd	3rd	4th	5th
Simple	SNS use	143.374 (66.965)	115.115 (63.285)	103.158 (50.638)	92.423 (46.432)
	No SNS use—break	151.956 (88.293)	123.914 (69.742)	137.002 (95.386)	117.683 (85.313)
	No SNS use—no break	160.897 (99.825)	122.417 (69.313)	134.610 (89.117)	101.838 (48.557)
Complex	SNS use	183.582 (125.957	170.416 (116.076)	165.486 (101.218)	126.640 (72.106)
	No SNS use—break	217.121 (140.818	147.575 (84.117)	150.495 (75.454)	132.869 (59.094)
	No SNS use—no break	189.896 (120.031	168.089 (126.511)	169.174 (118.509)	131.676 (59.160)

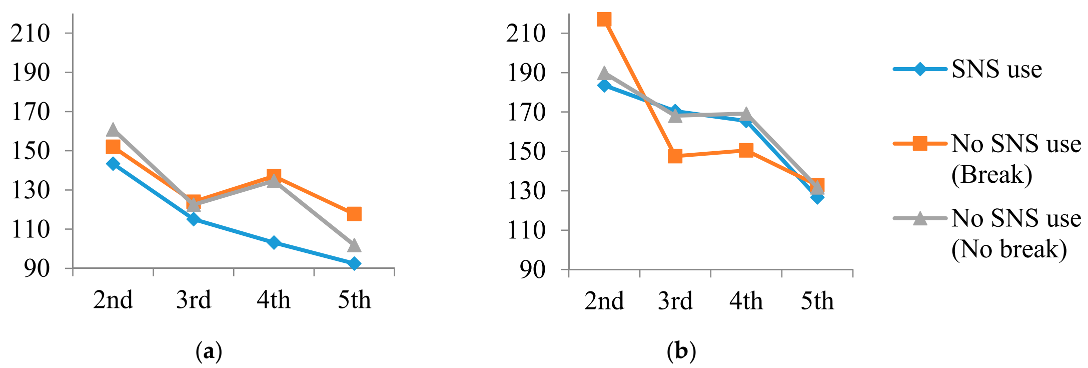

Figure 4. The time taken for each scheduling. (**a**) Simple Task Scheduling; (**b**) Complex Task Scheduling.

For the simple task, it is interesting to note that the time taken for the first half of the post-treatment scheduling (4th schedule) increased for participants in the no SNS use conditions, while it decreased for those in the SNS use condition. The ANCOVA result shows that this difference is statistically significant—$F = 4.054$ ($p = 0.048$) for between SNS use and break conditions and $F = 4.688$ ($p = 0.034$) for between SNS use and no break conditions. The time differences in the latter half of the post-treatment scheduling (5th schedule) across groups was not statistically significant, suggesting that the differences in post-treatment performance across groups can be attributed to the improved performance right after SNS use.

The same tests were conducted for the complex task. Although the data in Figure 1 seem to suggest that the performance of participants in the SNS use group slightly improved after SNS use while the performance of those no SNS use conditions was marginally impaired, the ANCOVA results did not show statistically significant differences across groups.

6. Discussion

The results of hypotheses testing and additional analysis suggest several interesting insights. First, although the psychological arousal scores of participants in the SNS use groups was significantly higher than that of those in the simple break groups, note that the initial psychological scores of both groups were higher than those following SNS use or break. A possible conjecture for this is that participants were initially aroused due to the fact that they were being subjects of an experiment in which an administrator installed a BCI headset on their heads that most of them have never worn or seen in their lives. This initial arousal seems to have been alleviated as the experiment proceeded. This does not mean, however, that the difference in treatment psychological arousal between the SNS use groups and simple break groups is the consequence of initial arousal. The result clearly suggests that SNS use made participants more psychologically aroused than did a simple break.

Although not supported, the test result for Hypothesis 2 suggests two things. First, a something that can operate as a short break, which is getting attention away from a task, in the middle of a task can be effective for decreasing stress. Second, for a complex task, this can be in any form: a simple break or SNS use. For a simple task, however, only the simple break not SNS use decreases stress level. A plausible explanation for this lies in how high the task performer's need to release attentional resource from a task is. When performing a complex task, in which the burden of the task is substantial, the effect of releasing attentional resource from a task for moments whether by SNS use or simple break may be dominant in decreasing stress. When performing the simple task, however, the burden of the task is moderate, and thus there may not be a high need for the task performer to release attentional resource. Therefore, the effect of releasing attentional resource from the task is not dominant enough to prevent stress rising from attentional resource allocated to SNS. This is consistent with the limited resource model of behavior regulation [68,69]. This model suggests that people need self-control to perform tasks, and that this self-control uses mental and physical resources such as attention and concentration. The tasks that are continued without breaks or need more effort require high levels of self-control and thus cause performers' stress [70]. When these resources are consumed, self-control is no longer possible. To do tasks continuously, therefore, people need to replenish resources. For this replenishment to be successful, recourse consumption level should be lower than resource replenishment level and a break makes this possible by alleviating the consumption of resources required for self-control [69]. The findings of this study imply that complex task performers need to replenish resources more, and taking time off from a task, regardless of its forms—simple break or SNS use—use fewer resources than doing tasks, thus also reducing stress level as well. The fact that only simple break reduced stress level when performing simple task can be explained similarly: a simple task does not require high levels of self-control, thus the level of resource consumption for doing simple tasks may not be much higher than the level required for using SNS. In other words, a similar amount of resources for task execution are consumed for SNS use, thus resource replenishment does not occur and meaningful stress reduction does not occur either.

For the simple task, the performance of participants in the SNS use group was better than those not subjected to SNS use. It is interesting to note that the only group of people whose post-performance was not significantly improved was the simple break group, even though it is also the only group whose post-stress level was significantly decreased. This finding confirms the theory that stress is not related to simple task performance but only to complex task performance. As distraction-conflict theory also suggests that high psychological arousal can have a positive effect on simple task performance, the significantly lower psychological arousal felt by people in the break group than that by people in the SNS use group can explain the relatively low performance of the simple break group. When performance is considered as time taken for each scheduling, the overall pattern of all three groups in Figure 1 shows a downward slope as the task proceeds, except for the fourth scheduling. While the performance of participants in the SNS use group maintains the descending path, those in the no SNS use groups take a longer time to perform the fourth scheduling than the previous one. For the break group, this pattern might be explained by the low psychological arousal they received from the break. For the no break group, it may be a result of the fatigue they feel from the consecutive scheduling. This performance impairment occurs only at the beginning of the post-treatment scheduling, as performance starts to improve again after that. Although this fluctuation occurs only briefly, the finding indicates that only the SNS use prevented this performance fluctuation, enabling performance to be sustainable.

For the performance of the complex task, the post-performance scores of all three groups are not significantly different, as hypothesized. For participants in the SNS use group, this lack of difference might be attributed to the positive effect of decreased stress being offset by the negative effect of high psychological arousal, as the theory suggests. For the break group, however, their stress levels decreased to as low a level as that of SNS use group and their psychological arousal level was significantly lower than that of the SNS use group. This seems to be contradictory to what the theory argues because distraction-conflict theory holds that they should thus have significantly better performance given that both these effects positively affect performance. However, given that how high psychological arousal must be to impair performance is unknown, the measured psychological level for the break group can still be problematic for performing complex tasks.

7. Implications

7.1. Theoretical Implications

This study attempts to provide new understanding of how SNS use affects task performance by examining its positive and negative effects simultaneously. The analysis of these results overall suggests that use of SNS functions better than a mere break in improving performance when participants are engaged in a simple task and no differently from a mere break when doing a complex task. This suggests that, although SNS use is commonly viewed as a distraction, it can have a better or at least the same effect as a simple work break, which is known to be a performance enhancer, therefore contribute to making performance to be sustainable.

The findings of this study suggest, first, that SNS can play different roles for different people or task environments. For some people performing a task that does not demand full concentration, SNS can serve as a conduit to deliver a sense of others' presence that is linked to increased performance. For some people who are engaged in a task that requires full concentration, SNS can be an attention-relieving break that is even socially enhanced. In this sense, this study contributes to the literature by challenging the prevalent belief that SNS use is a mere distraction and by adding new knowledge about when and how SNS use affects task performance.

Second, much of the literature concludes that SNS use has either positive or negative effects upon performance without explaining the mechanisms by which SNS use influences performance. This is partly because their methods are not designed to capture the effect of SNS use during a task, instead using retrospective means or simple comparisons of SNS users and non-SNS users. To help fill this knowledge gap, this study conducted a theoretically informed experiment and examined how psychological arousal and stress induced and mitigated by SNS use can play a role during a task.

Third, by using physiological measures to validate empirical research, this study enhances the methods used to reconcile physiological and psychological investigations. This is particularly useful when a gap exists between people's perceptions and behaviors. For example, Computers as Social Actors theory [71] suggests that people do not perceive computers as social actors, but rather that they react to them as they would to people in social settings. If an EEG shows that people's brain signals during SNS use display the same pattern as that during their face-to-face interactions with physical human beings, we can understand a great deal more about the relationship between people and technology than what psychometrics alone can reveal.

Fourth, the study challenges the assumptions of the current literature that view time and energy in work settings solely as fixed resources and thus personal SNS use as inevitably a distraction that reduces those resources. However, the findings of this study suggest that SNS can reduce stress that is related to task complexity. As occupational stress can have negative effects on the physical and mental health of people within the workplace [72], the personal use of SNS in learning and working environments, although admittedly consuming some time and energy, may ultimately serve not as a disruptive but as a productive distraction. The finding hints that seemingly wasted resources can preserve valuable resources somewhere else suggesting that the time and energy as the fixed resources in work setting should not be taken for granted.

Fifth, the findings of this study enrich the concept of social presence in distraction-conflict theory. While previous studies have limited such presence to physical presence, this study shows that the concept can be extended to online presence engendered by SNS. When combined with the Computers as Social Actors theory [71], which suggests that people react to technology as they would to other people, the findings of this study will further advance our understanding of how digital materiality, by creating a perceptual social world, impacts our social behavior and, as a result, adjusts our ontological world.

Finally, the findings of this study shed some light on enabling performance sustainability. An individual's sustainable performance is about not only enhancing their performance, but also avoiding a drop in performance by preventing *burnout* [50]. A break has been known to have positive effects on preventing cognitive fatigue and thus burnout [56]. This study suggests a new role of SNS: SNS use, which is usually seen as a distractor of performance, can in some situations provide a break that leads to sustainable performance.

7.2. Practical Implications

First, for managers of organizations, the findings of this study also suggest that personal SNS use among employees does not have to be entirely avoided. Rather, in some situations, its brief usage in the middle of work tasks should be even encouraged. Even though many organizations now acknowledge the need for short work breaks, these results suggest that, in some situations, SNS use can have a better effect than mere breaks. Entirely banning SNS use in an organization may be simple and easy to execute, but doing so may result in losing valuable chances for achieving not only the sustainability of individual performance but also the sustainability of organizational performance through enabling social interactions [73] and helping to find entrepreneur opportunities [74].

Second, managers should consider not only task types but also workplace environments. For example, when many people are working together in an open space, the psychological arousal generated from having people physically nearby may be enough to keep a person motivated and socially connected without engaging in SNS. On the other hand, employees who are working in isolated environments might find SNS use energizing.

Third, the field study of SNS use in organizational contexts [6] suggests that successful SNS use in an organization should not be restricted to work-related matters. This study provides a slight hint of the reason behind this finding. SNS use should not be directed to the way to increase stress, particularly when performing complex tasks. Restricting SNS use to work related matters not only decrease organizational SNS use itself but may also associate stress to organizational SNS; this study offers additional evidence that organizational SNS use should not be restricted to work-related matters.

Lastly, it is worth noting that the effect of SNS use is realized immediately, and thus workers can begin the task they engage after SNS use in an improved condition. For example, the increased psychological arousal produced by SNS use seems to prevent fatigue and enable fresh mental processing capability for simple task performers. The improved task performance by SNS use can be linked to the even better performance of the following task. Therefore, given that SNS effects can be propagated to later task performance, the positive effects of SNS use at the right moment can be magnified through time.

In conclusion, we are living in an era where our mundane activities are filled with technologies that distract our attention. If we cannot turn these off, then we should seek out their positive qualities—perhaps positive side effects of distractors—and think of using them wisely and helpfully for our life to be sustainable as it should be. Disruptive distraction can also be productive distraction, and momentary resource consumption can also be resource replenishment in the long run.

8. Limitations and Directions for Future Research

There are several limitations to this study. First, due to the inherent nature of experiment that needs to separate variables of interest from other factors and the requirement of this study to eliminate the presence of an administrator, it was possible to examine the relative differences in target variables among the experimental groups but not their complicated causal relationships and specific threshold that converts positive relationship to negative relationship or vice versa. In addition, to prevent non-treatment factors from affecting experiment results, treatments have to be given at the same moment for the same period of time across experimental conditions, without which it is not possible to conclude that the results are due to the treatment effects. For this reason, timing and duration of treatments in this experiment (SNS use and break) were fixed across conditions: at the end of the third scheduling for three minutes. If not controlled this way, there could be many alternative explanations for the result: the time taken for SNS use or break, frequency of using SNS or taking breaks, and task progress level when a performer used SNS or took a break. Although this is necessary to control an experiment and a task can be divided into as many subunits as possible, using SNS between subunits of a task is not entirely natural. Future studies may adopt the method to monitor people's SNS-related behavior in a more natural environment in a longitudinal way. Doing so may reveal a myriad of paths in which SNS use is connected to performance.

The current study revealed that the performance of a complex task by an SNS use group is indifferent from that of a no SNS use group. The theory and results suggest that this is because the positive effect of stress reduction offset the negative effect of psychological arousal. However, other factors may intervene in the interaction between stress and psychological arousal. Future research should focus on finding those variables and investigating the mechanism of how stress and psychological arousal affect each other when performing certain types of tasks.

This study used a single form of task, a scheduling task. Although the chosen task involved many types of task characteristics, such as decision making, solution finding, and varying degree of complexity, future studies may extend this study by using multiple different tasks that are different in nature and the time required to finish. Similarly, varying SNS usage time, purposes, and activities as experiment treatments in future study can help establish a more robust understanding of SNS use and performance.

This study delves into the relationship between SNS use and performance under the assumptions of distraction-conflict theory. Future research may adopt different theories as main theories such as the limited resource model of behavior regulation [68,69]. Future research may also investigate other causes of positive and negative effects of SNS use on performance such as a feeling of social integration and a compulsive need for using SNS than psychological arousal and stress. BCI devices such as that used in this study can provide a good mean to measure various emotional and physiological factors that can explain how SNS use affects performance.

9. Conclusions

The effect of SNS use on performance has been a controversial topic. As SNS use becomes a mundane activity for increasing numbers of people, focusing on when and where it can have a positive or negative effect on performance rather than simply categorizing that impact as positive or negative can help move us far beyond our current understanding of its influence. The findings of this study suggest that, contrary to the common view, short bouts of SNS use can enhance performance in a simple task environment and make no difference in performance in a complex task environment. This study demonstrates that high performance by SNS users on simple tasks may be associated with high psychological arousal. It also suggests that although increased psychological arousal produced by SNS use can impair performance in the case of complex tasks, the lowered stress it produced can offset this effect and maintain the performance level. The findings can be used to reconsider organization policies that are unfriendly toward SNS use, suggesting that when used selectively, SNS use can contribute to increasing the organizational level of productivity.

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