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Acute stress, friend or foe: An investigation of free recall ability for incongruent items when placed under acute psychological stress

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Abstract

Experiencing stress during a working week is typical for most of the population, but the effects of acute stress on individuals is less clear cut, particularly in relation to memory ability. Research suggests that acute psychological stress can enhance memory ability, due to increased neuroplasticity following stress and stress hormones diverting attention to information congruent to the stressful environment**.**

The current research investigated the effects of stress on free recall ability when the stimuli are incongruent to the stressor. Forty-four Psychology undergraduates were exposed to both a stress condition (Modified Trier Social Stress Test- free speech on Social Psychology) and a control condition (Spot the difference task) while remembering neutral incongruent stimuli. Participants experienced acute psychological stress from being told they would have to complete a stressful or non-stressful task. After this exposure, participants were tasked with remembering stimuli on a PowerPoint Presentation. Their memory ability was then assessed by their free recall of correct items; participants then completed the stressful or non-stressful task and gave a Likert judgement to rate the stressfulness of the task. Both conditions were experienced one week apart. The results indicated there was not a significant effect of stress enhancing free recall ability for incongruent stimuli, despite participants reporting the stress condition as significantly more stressful than the non-stress condition. Implications of future research in relation to stress improving memory, and familiarity with the stressor are discussed.

Keywords: experiencing stress, acute stress, psychological stress, environmental stress, free recall, incongruent stimuli, memory, social psychology

Introduction

In the United Kingdom, during a typical week, approximately 82% of people report having felt stressed at some point (Mental Health Foundation, 2018); therefore, we must begin to understand the relationships we have with different types of stress. Acute stress refers to an immediate time-limited physical, emotional or psychological response to a novel threat; these stressors can vary from mild to severe. The key is they are perceived as a short-term threat, and this triggers a short-term response (Hohoff et al., 2013). For example, a prominent acute stressor for many individuals is giving a speech in front of other people. The speakers can become hyper-aware and experience physiological symptoms as a response to the stress, but these effects only last for a short period as it is a singular event (Priem & Solomon, 2009).

Stress can be categorised as having two different types of effect: eustress or distress (Fevere, Matheny, & Kolt, 2003). Eustress is where there are positive consequences from stress, such as improved performance, focus and motivation. An example situation being excelling when starting a new job (Hargrove, Becker & Hargrove, 2015). Distress is where there are negative consequences from stress, such as anxiety, worse performance and negative physical symptoms, for instance, headaches and fatigue. An example situation being struggling from excessive job demands (Fevere et al., 2003). People often do not consider stress as positive, and typically “stress” is used to define unfavourable circumstances, which often leads to negative perceptions of experiencing stress (Gibbons, 2012). Jamieson, Mendes and Nock (2013) educated individuals diagnosed with a social anxiety disorder to interpret acute stress responses as maximising their performance. For example, a beating heart pumps more blood to the brain for thought processing and feeling worried implies you are excited. Those educated felt significantly better about giving a speech in front of an audience and thought it was a positive experience compared to those who were not educated. These results suggest perceptions of stress can be influential in how we interpret our own experiences with stress. Research has found chronic stress consistently impairs memory performance (Conrad, 2010), but identifying the effects of acute stress is less clear cut, as little is known about how memory is affected (Cahill, Gorski, & Le, 2003).

Previous research has aimed to identify how acute stress affects memory, and there is supporting research for both eustress and distress effects. For example, eyewitness accounts are known to be unreliable in remembering details of the crime (Lacy & Stark, 2013). A meta-analysis conducted by Deffenbacher, Bornstein, Penrod and McGorty (2004) looked at the effects of acute stress from crime on eyewitness’ memory ability when the studies were separated into free recall or interview recall. They found the interview group exhibited distress effects of reduced recall compared to those who could freely recall information. Arguably, the interview itself was stressful, and it is this extra stress that negatively impacted retrieval, not the stress from the crime, as found in the free recall group. Due to this, the effects of stress at the time of the incident and during the interview cannot be separated, so whether acute stress is detrimental to memory is not determined. Additional supporting evidence of acute stress causing distress effects of memory impairment comes from Schwabe and Wolf (2010). They found exposure to perceived social evaluation during a cold-pressor test, reduced word recall and recognition by 30% compared to a control group, who submerged their hands in warm water. The social evaluation during a cold-pressor test involved participants immersing their hand in

ice-cold water while being watched and videotaped. The stress condition led to increases in blood pressure, cortisol levels and stress ratings. The increase in stress and decreased recall ability suggests that acute stress can challenge long term memory. Hockey (1970) stated that stress tests our ability to concentrate our attention; this might be why we exhibit distress effects of impairment.

However, participants experienced two different types of stress at once, physiological stress from the cold-pressor task and psychological stress from the social evaluation. Different types of stress activate different brain areas. The physiological stress from pain activates the anterior cingulate cortex, which encodes emotions and memories for unpleasantness (Rainville et al., 1996). In contrast, psychological stress activates the amygdala, which increases the amount of noradrenaline in our system. This increase in noradrenaline promotes memory enhancement for information imperative to the immediate environment (McGaugh, 2004). Pain is known to negatively impact memory (Kuhajda, Thorn & Klinger., 1998) and Schwabe and Wolf (2010) do not separate the effects of the two different stressors. Consequently, these results cannot be interpreted as both physiological and psychological acute stress causing distress effects. Schwabe and Wolf (2010) suggested memory enhancement only occurs when the nature of what is being learnt helps the individual cope with the current stressful situation. Joëls et al. (2006) proposed information congruent to the perceived stress enhances memory because the stress hormones: noradrenaline and cortisol, divert attention towards information relevant to the current situation. Being aware of our environment was optimal to our evolutionary survival, but it can still be beneficial in the present to adapt successfully to new environments (Kotchoubey, 2018). This idea can explain why stress can cause eustress effects of enhancement; the information learnt is congruent and supports adaptation to new stressful environments (Joëls et al., 2006). It can also explain why distress effects of impairment occur; people become attentionally ignorant of information that does not support adaptation or benefit us in the context we are in (Chun & Turk-Browne., 2007).

The effect of context congruent memory enhancement has been consistently demonstrated in rats; recent research by Lipatova, Campolattaro, Dixon and Durak (2018) investigated the relationship between acute stress and a rat's memory ability. They trained rats over two days to complete an open field tower maze. Food was placed on one of four towers, and the rats had to navigate the maze from a specific start point and scale the correct tower to access the food. After a 37-day break, the rats experienced acute stress of being restrained for 30 minutes or not, before having memory trials of finding the food. Lipatova et al. (2018) found there was better food retrieval when the stress was administered before the task, and the rats that experienced acute stress had better memory performance than controls when their start location was changed. These findings suggest exposure to acute stress before learning enhances memory to adapt to different contexts. Arguably, the stress focused the rat's attention on information key to survival; the food and freedom; which allowed them to benefit from eustress effects.

Leading from Schwabe and Wolf (2010) and Joëls et al.'s (2006) proposal, Smeets et al. (2007) demonstrated a eustress effect of memory enhancement with humans. Participants were tasked with memorising stress-related material as part of their recall task, and they were split into three groups; a stress personality group, a stress

memory group and a non-stress group. The non-stress group watched a neutral film as a filler before the memory tasks, whereas participants in the two stress groups were tasked with a modified version of the Trier Social Stress Test (TSST). TSST is a realistic psycho-social paradigm that combines tasks known to elicit high stress (Kirschbaum, Pirke & Hellhammer, 1993). In the modified TSST, stress was induced by performing an arithmetic task and giving a free speech about memory or personality in their non-native language; in front of an audience while being videoed. Participants were then presented with a word list to remember congruent to their speech topic; they had a period of immediate free recall and 24-hour delayed-free recall. Smeets et al. (2007) found that only those in the personality context-congruent condition showed memory enhancement when in the 24-hour recall delay condition. Enhancement was significantly related to increased stress measured by the amount of cortisol in saliva after the TSST. An explanation for the enhancement of the personality and not memory condition could be due to the difficulty of stimuli. Smeets et al. (2007) acknowledged the memory material might have been harder and more specific to remember than the personality material, which could account for why there was no memory enhancement effect for recall of the memory material.

Stress has been found to increase neural birth, and these immature adult-born neurons have increased plasticity (Ge et al. 2007). Marín-Burgin, Mongiat, Pardi & Schinder, (2012) built on these findings, to propose a more recent explanation for why eustress effects of memory enhancement occur after acute stress. They found using electrophysiology and calcium imaging techniques that immature adult-born neurons in the hippocampus exhibit increased excitation when integrating environmental signals compared to mature neurons. They proposed it is the increased excitation and plasticity of immature neurons that allows memory enhancement, as the hippocampus is vital for long term memory consolidation. This proposal was further supported by Kirby et al. (2013), who investigated hippocampal plasticity in rats experiencing moderate acute stress. They restrained rats for three hours or administered a cortisol injection to elicit acute stress; they found an increase in neural birth that persisted for 24 hours. Afterwards, the rats were put into a box and shocked to build up a fear association, the following two days the rats were put into the box without shock to extinguish this link. Only the rats in the stress condition stopped their freezing behaviour in the box, which suggests the rats successfully recalled the box no longer shocked them. Kirby et al.'s (2013) findings imply neurons born from stress enhance memory; however, these effects were only prominent two weeks post-learning.

These findings bring interesting insight into how stress could impact neurons in humans, which has implications for memory. If neurons formed from stress have increased environmental excitation, would information learnt have to be congruent for memory enhancement to occur? Pearce and Hall (1980) found it is unfamiliar information that increases dopamine neuron activation, and as information becomes familiar, activation and attention decrease. Therefore, there could be an enhancement for learning incongruent information when stressed. As the information learnt is not linked to the stress, this could increase neural activation in the hippocampus to promote attention to aid long term memory (Roffman et al., 2016; McNamara et al., 2014).
Recent evidence supporting acute stress causing a more immediate enhancement in humans comes from Vogel and Schwabe (2016), who explored the relationship

between stress and memory in a natural environment. Participants were divided into a stress and non-stress condition, they provided a cortisol saliva sample and completed subjective mood scales pre and post-test. In the control condition, participants had to talk about a book or movie, followed by a mental arithmetic task without social evaluation. In contrast, in the stress condition, participants were given a modified TSST, where they had to give a 15-minute job application speech and complete a mental arithmetic task while being videoed and evaluated by two confederates. Participants carried cameras around a two-hour zoo tour, and they were told to photograph and memorise as much as possible. Seven days later recognition for their photographs was tested. Vogel and Schwabe (2016) found higher stress levels from the TSST, enhanced memory ability compared to controls; the most significant enhancement was for pictures taken 45 minutes after the TSST. These findings suggest there is a more immediate enhancement effect in humans after experiencing acute stress. However, the salience of the environment was not considered and could have impacted the results. For example, participants may be more likely to remember zoo photographs compared to laboratory photographs.

The present research aims to build on the work of Smeets et al. (2007) by investigating the effects of acute stress on incongruent learnt items. With consideration of the recent findings of increased neuroplasticity from stress and for new information, there is a possibility that there could be more immediate memory enhancement effects. The current research has counterbalanced its stimuli and order of presentations to prevent salience or difficulty from impacting recall ability, which could have influenced Smeets et al. (2007) and Vogel and Schwabe's (2016) results. The goal of the research is to discover whether acute stress can enhance memory ability for images incongruent to the stressful task. Therefore, the independent variable was the type of task participants completed; stressful or not. The dependent variable was the amount of correctly recalled images in the free recall period. The hypothesis for this paper is as follows: firstly, participants in the stress condition would correctly remember more words in the free recall part of the experiment than those in the non-stress condition. And secondly, participants in the stress condition would rate the stress condition as being significantly more stressful than the non-stress condition.

Methodology

Design

A two-part within-subjects design was used to investigate the effect of acute psychological stress on free recall ability; participants experienced both a stressful and non-stressful condition. The independent variable manipulated was the task participants completed after studying and recalling 30 15x15cm images and whether it was stressful. The control condition was a spot the difference picture task and the stress condition was a modified version of the TSST; where the participants gave a 1-minute free speech in front of the other participants on the topic of Social Psychology. The dependent variable measured was the number of images correctly recalled in the free recall period. The counterbalance design was 2x2, with the presentation of PowerPoint A and B and the presentation of a stress or non-stress task differing in Part 1 and 2 of the research, to manage difficulty and order effects.

Participants

Forty-four Stage One and Two Psychology students from the University of Plymouth were participants, due to participants withdrawing 36 participants data was used (Male 4; Female 32; M_{age}= 19.92, *SD*=2.52, age range: 18-33). Participants were recruited voluntarily from the Psychology Participation Pool as partial fulfilment of the course and those who took part in both parts of the research were granted course credit in the form of one participation point.

Materials

1. Due to counterbalancing two-combined brief/consent, sheets were created to inform the students of the nature of the research and what they would be taking part in for each half of the experiment.
2. A debrief for the experiment was created to explain the interest in stress and the potential enhancement effects it could have on memory, it also included information on previous studies and contact details for the researcher and supervisor.
3. Two PowerPoint presentations loaded with timed slides of 30 15x15cm images and instructions for the two different phases of the experiment.
4. The neutral images used in the PowerPoint presentations were taken from the website Pixabay.com.
5. One sheet of numbered A4 paper to record free recall answers per part of the experiment.
6. One sheet of paper with the Likert judgement stress manipulation check statements and control statements on, to determine if the stress task was more stressful than the non-stress task. Participants rated from 0-10 how stressful the Free Speech and Spot the difference task was for the manipulation check. Each participant rated three control Likert judgement statements ranging from 0-4 on how much they agreed the task was stressful, distracting and affecting on performance for both conditions.
7. A phone timer was used to time the participants one-minute free speech.
8. For the control task, a spot the difference task was taken from the website Supercolouring.com and printed on A4 paper.

Procedure

Part 1

At the appropriate time and when in the correct room with computer access, the participants were given verbal and written instruction of the brief. Participants were asked to sign the consent form should they wish to continue with the experiment. Participants were told they were free to leave at any point without fear of repercussions and that their data would be anonymised for confidentiality. Once all of the participants had signed the consent form, they were verbally told the task they would have to complete, after memorising the PowerPoint images, completing a rehearsal prevention task and then after recalling the images, would be a spot the difference task. Afterwards, participants were instructed to start the preloaded PowerPoint presentation and follow the instructions when they were ready. Participants were presented with 30 15x15cm images one by one on the computer screen for 3 seconds; during this time, participants had been instructed on the PowerPoint to memorise the images. After all 30 images had appeared on the screen, participants were instructed to take a 1-minute PowerPoint-timed break that involved them counting back from 768 in 3’s to prevent rehearsal of the stimuli.

After the break participants were instructed via PowerPoint to write down on the recall piece of paper all of the images they could remember from the presentation. After, participants were reminded they had two minutes to complete a spot the difference task, which was timed by the PowerPoint slides. Upon completion of part one of the research, participants were thanked for taking part and reminded of the second date to finish the experiment.

Part 2

The procedure in Part 2 of the research was identical to the procedure in Part 1, except the following. Before beginning participants were verbally told, they would have to stand in front of the researcher and other participants and give a one-minute free speech on the topic of Social Psychology.

After the participants had finished the recall task; they were timed to free speak about Social Psychology for one minute on a mobile phone timer. Following the speeches, participants were asked to complete the stress manipulation Likert statement ratings. Participants were then given a verbal and written debrief of the nature of the experiment and thanked for taking part in the research. Participants were told should they have any questions or concerns to contact the researcher or supervisor for further information.

Results

To test the hypothesis: that experiencing a higher level of acute stress would enhance memory performance, a t-test was used to compare the amount of correctly recall words in a stress condition compared to a non-stress condition; for 36 participants. Descriptive statistics are presented in Figure 1 below.

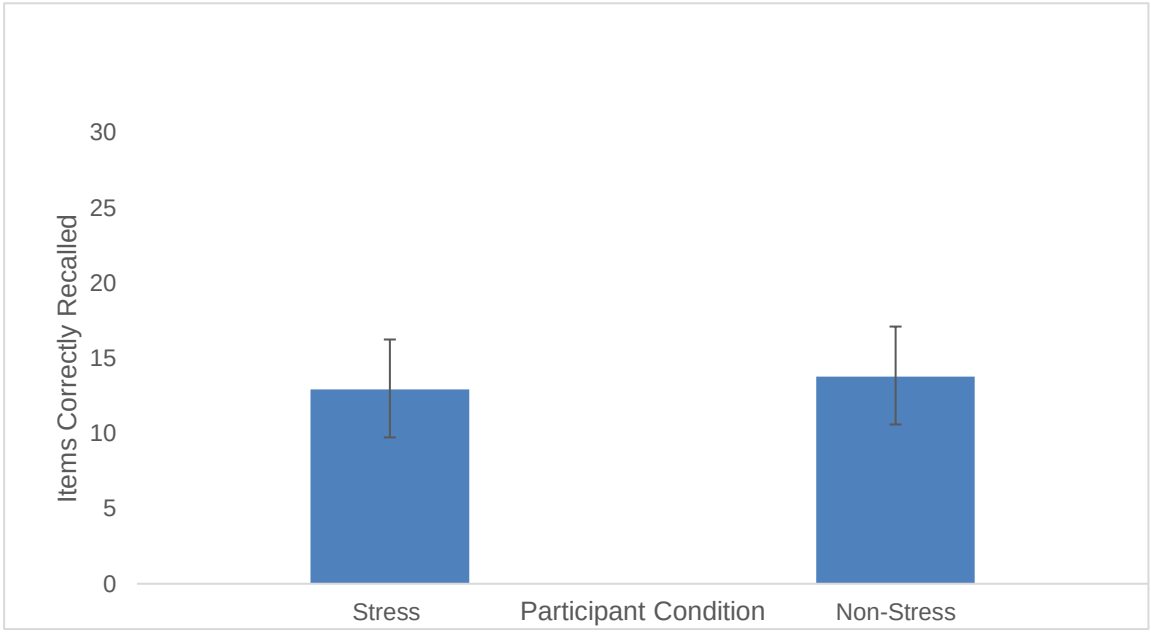

Figure 1: A bar chart depicting the different mean scores for correct item recall in the Stress and Non-Stress condition with Standard Error Bars. The data compiled is of N=36.

To test if stress enhances memory by improving item recall, a paired-samples t-test was used to compare the number of correctly recalled items in a stress and non-

stress condition. There was not a significant difference between the number of items correctly recalled between the stress condition (*M*= 12.92, *SD*=3.32) and the non-stress condition (*M*=13.78, *SD*=3.19), *t*(35) = -1.58, *p*= 0.122, *d*= 0.26 . This non-significant result suggests the amount of stress experienced did not have an enhancement effect on the correct number of items recalled. However, there was a statistically significant difference using a paired samples t-test to compare the stress experienced in the stress condition (*M*= 6.77, *SD*= 1.61) and the stress experienced in the non-stress condition (*M*= 1.37, *SD*= 2.05), *t*(34) = 13.95, *p* < 0.01, *d*=2.93. One participant did not complete this measure; therefore, their data was excluded leaving 35 participants data. These results suggest the stress condition was significantly more stressful than the non-stress condition. For additional analysis on recall ability and the effects of stress, a paired-samples t-test was conducted to compare the total number of items recalled. There was not a significant difference between the total number of items recalled between the stress condition (*M*=13.08, *SD*=3.32) and the non-stress condition (*M*=13.89, *SD*=3.19), *t*(35) = -1.48, *p*= 0.149, *d*= 0.25. These results suggest the amount of stress experienced does not increase the total number of items recalled.

A Pearson's correlation was conducted to measure the relationship between the number of items correctly recalled in the stress condition, and participants five-point Likert judgement answers on three control questions. There was no significant correlation between the number of correct items recalled and participants judgement of stress, *r*(34) = -.17, *p*=.311. There was no significant correlation between the number of correct items recalled, and participants judgement of feeling distracted, *r*(34) = -.29, *p*=.085. And finally, there was no significant correlation between the number of correct items recalled and participants judgement of feeling their recall was affected by stress, *r*(34) = -.22, *p*=.203. This suggests that the participants' perceptions of feeling stressed, distracted, or that judgement could be affected did not influence their memory recall for correct items in the stress condition. Furthermore, a Pearson's correlation found no significant relationship between the three control Likert judgement statements in the stress condition. There was no significant correlation between the Likert judgement score for stress and feeling distracted, *r*(34)= .29, *p*=.087. There was no significant correlation between the Likert judgement score for feeling stressed and feeling the free speech affected their recall ability, *r*(34)=.20, *p*=.247. And finally, there was not a significant correlation between the Likert judgement for feeling distracted and feeling the free speech affected their recall, *r*(34)= .26, *p*=.120. This further suggests that the perception of feeling stressed, distracted, and as though their recall was affected was not related in the stress condition.

An additional Pearson's correlation was conducted to assess the relationship between the number of items correctly recalled in the non-stress condition, and participants Likert judgements on three control questions. There was no significant correlation between the number of correctly recalled items and the Likert judgement for stress, *r*(34)= .24, *p*=.164. There was no significant correlation between the number of correctly recalled items and the Likert judgement for feeling distracted by the non-stress task, *r*(34)= .20, *p*=.246. There was no significant correlation between the number of correctly recalled items and the Likert judgement for feeling as though the non-stress task affected their recall ability, *r*(34)= .01, *p*=.956. This suggests that the participants' perceptions of feeling stressed, distracted, or that their judgement

could be affected did not influence their memory recall for correct items in the non-stress condition. Furthermore, a Pearson's correlation found three significant associations between the three control Likert judgement answers for the non-stress condition. There was a significant correlation found between the Likert judgement of perceived stress and for feeling distracted by the non-stress task, $r(34)= .70$, $p<.001$. There was a significant correlation found between the Likert judgements of perceived stress and for feeling as though the non-stress task affected their recall ability, $r(34)= .56$, $p<.001$. There was a significant correlation between the Likert judgements of feeling distracted by the non-stress task and feeling as though the non-stress task affected their recall ability, $r(34)= .58$, $p<.001$. Furthermore, this suggests there was a relationship between the non-stress condition and the participants' perception of feeling stressed, feeling distracted and feeling as though their ability was impaired.

Discussion

The current research aimed to investigate the impact of acute psychological stress on free recall ability when the information learnt was incongruent to the stressor. It was hypothesised that a more stressful task would elicit a eustress effect of enhanced free recall compared to a non-stressful task. This prediction was based on stress increasing neural birth, and the new-born neurons being more susceptible to excitation from stress (Marín-Burgin et al., 2012). Instead, a non-significant result was found for the correct number of items recalled in the stress condition compared to the non-stress condition. The results suggest the acute stress experienced did not cause a eustress or distress effect on memory. However, participants reported finding the stress condition significantly more stressful than the non-stress condition. These results suggest the stress experienced by participants was strong enough to be differentiated and impact their perception of the stress. But, when the two stressors were further analysed using the control Likert statements, there was no significant effect of stress, distraction during learning and feeling as though their ability was affected, in influencing the number of correctly recalled items.

This research aimed to build on findings of Joëls et al. (2006), supported by Smeets et al. (2007), by investigating the relationship between incongruency and a stressful task. According to this research, there should be a distress effect of memory impairment in the stress condition because attention fixes on information that benefits adaptation to the stressful situation, i.e. is congruent. Therefore, there would be significantly less attention paid to the incongruent stimuli as it does not aid the current situation. However, the results do not support this theory, as there was no significant difference between the correct number of items recalled across conditions. Although the stress condition was reported as more stressful, no distress effect occurred. It is crucial to note Joëls et al.'s (2006) explanation that incongruency between stress and stimuli causes memory impairment due to less focused attention has limited experimental support. Therefore, this research could explain what happens when information is incongruent, that less attention is paid to it as it does not benefit the situation, so there is no enhancement. But because the information is still relevant to the individual's current environment, enough attention is paid to recall information at a standard rate, which may explain the non-significant result.

This research also aimed to integrate more recent findings from Marín-Burgin et al. (2012), who suggested stress can increase neural birth, and when neurons are immature, they have increased excitation to the environment. Pearce and Hall's

(1980) findings contribute to this, as dopamine neurons fire more when the environmental information is unfamiliar, and activation decreases with familiarity. Therefore, according to this explanation, there should be an enhancement effect on participants free recall ability in the stress condition because the stimuli are incongruent to the stress task. This should increase neural firing as the stimuli are unfamiliar in this sense, meaning there is more attention to consolidate memory. However, there was not an enhancement for free recall in the stress condition; there was not a significant difference between conditions, despite the stress task being reported as more stressful than the non-stress task. The non-significant result could be because the stress task was a free speech on a topic familiar to the participants; Social Psychology. And because the stress, not the stimuli, was familiar, there could have been a lower rate of neural birth and firing, which would make the stress and non-stress tasks too alike, resulting in a non-significant result. The possibility of the stress task not being stressful enough is further supported by the Pearson's correlations conducted, which indicated the perceptions of stress and performance was not significantly correlated with the number of correct items recalled. We would expect there to be an effect between perceived stress, distraction and affected performance if the task was stressful enough, but this was not the case. This paper is evidence against Joels et al.'s (2006) theory that incongruency between a stressor and learning material could cause a distress effect on memory. The results were inconclusive for confirming or denying Marín-Burgin et al.'s (2012) theory of increased neural activation for incongruency enhancing memory.

While the current research did not find an enhancement effect for memory in the stress condition, several limitations need to be addressed before memory enhancement from incongruent acute stress is discounted. Due to the ethics of advertising the research for the students to participate in, we had to disclose to potential participants that they would have to take part in a task involving public speaking. Therefore, there would be some prior knowledge that participants may experience stress; humans are known to undertake avoidant behaviour if they experience fear or stress (Cornwell, Overstreet, Krimsky & Grillon, 2013). Individuals who have fear anticipation about public speaking, due to a fear of negative evaluation are more likely to experience stress, and those who do not fear public speaking are less likely to experience stress (Durlik, Brown & Tsakiris, 2014). Therefore, those who experience higher levels of stress from public speaking are less likely to have signed up to take part, and this could have resulted in a sample bias. A bias could account for why there was no significant difference between correctly recalled items in the stress and non-stress task. Even though public speaking was reported as more stressful, the stress experienced was not enough to cause an effect. Additionally, due to the nature of sample collection through the university's participation pool, only a limited number of students could be recruited. There was also a notable withdrawal rate which could have contributed to an insufficient sample size; this could have impacted the results. Stress and experience are subjective; therefore, because of the individuality, it is likely that enhancement or impairment effects are small. Therefore, future studies should aim to gather a larger sample size to determine if there is an effect. Furthermore, enhancement or impairment effects may have been small over the studies 20-minute period; other studies have used a larger time period to gather their results. The analyses ability to detect any effects could have been impacted due to the limited statistical power and time constraints.

Another limitation that could have played a substantial role in undermining the predicted enhancement effect is the familiarity of the stressor to the participants. Pagano (1973) investigated the physiological and psychological stress levels of participants, using skin conductance and self-report ratings when completing a familiar task compared to an unfamiliar task. He found participants exhibited less physiological and psychological stress when completing the familiar task; they reported it as less threatening and easier to adjust to. However, Pagano (1973) also split participants into two groups, those more prone to stress and those less likely to experience stress. Both groups found the familiar task significantly less stressful than the unfamiliar task. Therefore, in the current research, the non-significant difference between the stressful and non-stressful condition could be accounted for by familiarity with the stress. Even though participants reported the stress condition as more stressful than the non-stress condition, it may not have affected them as much as it was a familiar topic they had to speak publicly about. As all participants were psychology students, they had an understanding of the topic and thus would have felt the situation was less stressful than speaking about an unfamiliar topic. Further analysis of the perceptions of the task in the non-stress condition, found increased feelings of stress, distractedness and as though their ability was impaired, despite the task being reported as significantly less stressful than the stress condition task.

These findings suggest that it is the unfamiliarity of the task, paired with finding the task stressful that could be essential for memory enhancement effects.
The results of this paper indicate there may be a role for familiarity in determining the effects stress has. Due to the limited research on the impact of the stressors' familiarity on enhancement or impairment effects, more research in this area is needed. This could be crucial in developing our understanding of why practising stressful tasks could help reduce distress effects. For example, regularly practising speaking in front of an audience, although daunting, helps you feel less stressed in the long term (Laborda et al., 2016). Our perception of stress is key to the effects we experience; unfamiliarity feels threatening but could produce more enhancement effects due to increased attention. Then when the stress becomes more familiar, it becomes less threatening, and we can engage more comfortably with it. Although there may not be memory enhancement from familiar stress, we can still experience other eustress effects, such as increased motivation (Strack, Lopes, Esteves & Fernandez-Berrocal, 2017; Simmons, 2000). Therefore, research into familiarity and perceptions of stress could be vital to understanding eustress effects.

Conclusions

Acute psychological stress has different effects depending on the context; the findings in this paper suggests if there is incongruency between the stressor and environment, there is unlikely to be an effect on memory. However, consideration must be taken of how familiar the stress is to the individual, and whether our perceptions of the stress could determine the impact it has. Future research needs to take familiarity into account to determine if it reduces attention to the stress resulting in normal memory ability, and if initial unfamiliarity is what can cause memory enhancement.

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