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Greetings,

Welcome to the third official edition of the Undergraduate Psychology Journal (UPJ) since 2003! Over the past year, much work has been put in by our team members, graduate editors, and peer editors to produce this issue. Each paper tells a story of assiduous review, revision and renewal. The experience led us to truly appreciate the meaning of *research*, a process of rigorous and relentless 're-search'. While the published studies may not yet have the sophistication of expert research designs, they were the footprints of students who took their first steps into this field. By sharing their hard work with everyone, we hope to encourage them in this quest, and to invite more people to join them. After all, roads are only formed where many people walk persistently.

Psychology is a dynamic discipline that holds many stimulating answers and even more thought-provoking questions. Over the last decade alone, more than three hundred thousand psychology studies were published. It is exciting to think some of the people reading or contributing to this journal will be involved in producing that new three hundred thousand (or more, probably) in the next decade. We believe with much revision and re-appraisal, you will also produce research that can re-read by others in future, and we hope this journal will add a little spark along the way as you set out to meet that goal.

Sincerely,

Rachel Hu & Marlene Gobrial
Editors-in-Chief

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NEURONAL GAP JUNCTION BLOCKERS: NEW TREATMENT FOR THE PREVENTION OF POST-TRAUMATIC STRESS DISORDER (PTSD)

Brandon Mahal
University of California, Los Angeles

Abstract

Fear conditioning has been used as one of the most powerful models to investigate the mechanisms of associative fear learning and memory in the mammalian brain. Previous studies have established that chemical synapses are involved with fear learning; however, electrical synapses have been overlooked and therapeutic advancements targeted at alleviating fear related disorders have been stalled. We propose that electrical synapses are important for synchronizing spontaneous correlated activity within the brain and are included in the complex framework of the formation of fear memories. Our studies reveal that blocking the communication between electrical synapses prevents learning of fear memories, suggesting that electrical synapses do indeed play a role in the formation of fear memories. These results imply that therapeutic treatments targeted at blocking electrical synapses could provide relief from fear and anxiety related disorders, such as Post-Traumatic Stress Disorder (PTSD).

Introduction

Post-traumatic stress disorder (PTSD) is an anxiety disorder that can develop after exposure to one or more terrifying events that caused physical or mental harm to an individual. Some of the major symptoms of PTSD include vivid and recurrent recall of traumatic memories, heightened sense of defensive behaviors towards non-threatening situations, cognitive impairment, and avoidance of stimuli associated with the trauma (Fanselow & Poulos, 2005). Such responses suggest altered fear response mechanisms, behavioral sensitization and failure of extinction. In addition to biochemical changes, PTSD also involves changes in brain

morphology. In a recent study, combat veterans of the Vietnam War with PTSD showed a 20% reduction in the volume of their hippocampus, compared to veterans who suffered no such symptoms (Carlson, 2007). Therefore, PTSD is often an undesirable consequence of combat during war.

Using Pavlovian fear conditioning as an animal model, great advances have been made in understanding the neural systems mediating fear memories and fear responses such as PTSD. Fear conditioning involves the pairing of a neutral stimulus with an aversive event. For example, in the lab, rats are trained by pairing a neutral stimulus, such as a tone, with an aversive event, such as a shock. Specifically, a tone plays and a 1-milliamp shock immediately follows the tone. Upon subsequent exposure, the neutral stimulus (the tone) will elicit a long-lasting fear response by its sole presentation without the tone (LeDoux, 1993). In the lab, this fear response is recorded as the amount of time rats spend freezing (Maren, 2001). In both the clinic and laboratory, fear (freezing) can be reduced by extinction, which consists of many presentations of the conditioned aversive stimulus (the tone) without the aversive reinforcer (the shock) (LeDoux, 1993). We propose to use fear conditioning in rodents to identify a unique target for the prevention and treatment of PTSD.

The hippocampus is a limbic structure central to the fear and anxiety system, and abnormally high activity in this area frequently occurs in the clinical presentation of PTSD (LeDoux, 1993). Specifically, the hippocampus forms bidirectional circuits with cortical and subcortical areas including the prefrontal cortex and the thalamus, so that neuronal hyper-excitability can spread throughout the entire network. These connections that the hippocampus makes are believed to be involved with spatial and contextual memory (Smith & Mizumori, 2006). Therefore, in fear conditioning, the hippocampus is responsible for consolidating memories associated with both the natural fear stimuli, and the context in which the fear stimuli are presented. Therefore, inappropriate excitation levels of the hippocampus can result in changes in consolidation, storage, recall and extinction of fear memories associated with the context and fear stimuli, which is characteristic of PTSD (Raineki & Holman, 2009).

While some of the present treatments for PTSD patients combine psychotherapy with anxiolytics or mood stabilizers, research on the pharmacological modulation of fear acquisition and extinction is largely targeted at chemical synapses. However, the complexity of the symptoms, the lack of successful treatment and the slow development over time of PTSD urges for the search of new therapeutic routes that also target electrical synapses. Furthermore, the discovery of such new therapeutic targets has been sparse, thereby forcing the pharmaceutical industry to create new compounds around existing molecules. These drugs have proven inadequate for PTSD and are often associated with high risks of relapse (Carlson, 2007). This problem arises because current pharmaceutical treatments target specific areas of the brain, thereby ignoring the role that electrical synapses play in the synchronous properties of the brain and fear circuitry.

In comparison to chemical synapses, electrical synapses conduct nerve impulses at a faster rate because they do not require the release of neurotransmitter to send a message to the connecting neurons. Rather, an electrical synapse is a narrow link between two neurons that is formed by gap junctions. This synaptic region connected by gap junctions brings the two connecting neurons within 3.5 nm of each other, as opposed to the 20 to 40nm separation found in chemical synapses (Bennett, 1997). Gap junctions are made of connexin-36 proteins that form hemichannels providing a unique, fast and reliable mode of cellular communication via ions and small particles among neuronal populations, as opposed to chemical synapses that use slow

acting neurotransmitters to bind to receptors of post-synaptic neurons (Fanselow & LeDoux, 1999).

Synchronous oscillations in the brain are largely achieved via the gap junctions of the electrical synapses, and are key in promoting interactions among regions central to the fear circuitry. Specifically, electrical synapses are responsible for the synchronous communication of the brain (Bennett, 1997). The gap junctions of the electrical synapses are the passageways to electrical current that allow different regions of the brain to communicate and interact synchronously. Here, we propose a new approach using blockers of gap junction protein, which are downstream of all known targets. Blocking gap junction proteins controls the overall brain network synchronization activity rather than single brain regions.

In devising a method to block gap junction proteins specific to electrical synapses in the mammalian brain, we had to use gap junction blockers specific to the connexin-36 proteins, which compose the gap junctions in these electrical synapses. Previous studies revealed that both mefloquine and carbenoxolone specifically bind to the connexin-36 proteins of gap junctions, thereby blocking flow of electrical pulses through electrical synapses (Martin & Handforth, 2006). Therefore, mefloquine and carbenoxolone became good candidates to perform a gap junction block on the connexin-36 proteins in the electrical synapses, which would disrupt normal oscillatory activity in the targeted region.

Normal oscillatory activity within regions of the fear circuitry is shaped and controlled by the GABAergic population electrically coupled via connexin-36 containing gap junctions. Past in vitro studies reported that blocking neuronal gap junctions in the amygdala could disrupt the maintenance of oscillation frequencies that occur in vivo during normal emotional processing (Belluardo, 2000). We therefore hypothesize that if PTSD represents a dysregulation of a network of several brain regions normally coordinated by synchronized rhythmic activity controlled by gap junctions, then targeting the function of gap junctions of electrical synapses within the hippocampus will provide a new innovative and unexplored route to prevent the development of PTSD. Specifically, we hypothesize that blocking the gap junctions in the hippocampus during fear conditioning prevents learning of the aversive stimulus, which thereby prevents a recollection of the traumatic experience in the form of PTSD.

The formation of PTSD is the result of fear reactions that translates at the network level by aberrant communication between cortical and limbic brain regions of the fear circuitry. Normal communication between these areas is controlled by synchronized neuronal activity mediated in part by gap-junction containing electrical synapses. The goal of this project is to modulate the function of electrical synapses by blocking the gap junction proteins (using carbenoxolone and mefloquine) in the dorsal hippocampus associated with the communication of the electrical synapses in the fear circuitry. Targeting gap junctions provides a novel and, yet, unexplored treatment for the prevention and reduction of PTSD. Furthermore, if this research proves successful, we will have a new method of combating PTSD before the traumatic experience even occurs. Therefore, this research proves especially useful for soldiers prior to entering the battlefield context.

Methods

The study was performed using 35 male Long Evans hooded rats (300-450 grams, Harlan, Indianapolis, IN). The rats were individually housed on a 12-hour light/dark cycle in hanging cages and given ad lib accesses to food and water. All rats were cared for in accordance

with guidelines established by the University of California, Los Angeles and approved by the UCLA Chancellor's Animal Research Committee.

Surgery

Rats were anesthetized with isoflurane. An incision was made across the midline of the scalp in which the tissue and skin were retracted exposing the skull. A craniotomy was performed over the site of cannula insertion (dorsal hippocampus). The orientation of the skull was adjusted so that lambda and bregma (coordinates of the skull) aligned in the same horizontal plane. Infusion cannulae (33 gauge) were positioned 3.7 mm anterior, 2.5 mm lateral, and 2.5 mm ventral to bregma. Infusions (20mg/ml) of gap junction blockers carbenoxolone (n=10) and mefloquine (n=9) and of Vehicle (control experiment, n=16) low magnesium ACSF (20mg/ml) were made separately via a 5-μl micro syringe (Hamilton Instruments) connected to Polyethuylene (PE20) tubing attached to infusion cannula. Compression of the syringe was produced by a syringe pump (Harvard Apparatus, South Natick, MA) at a rate of 0.1 μl/min. Total volume infused at each of the 2 sites was 0.3 μl. At the termination of the infusion, cannulae were maintained at the site of infusion for an additional 2 minutes to allow for the diffusion of gap junction blockers from the tip of the cannulae. Dental cement was then applied to secure the cannulae to the skull. Thereafter, all animals were given the antibiotic, baytril, in their drinking water for the next 5 days, as well as intraperitoneal injections of the analgesic/anti-inflammatory ketoprofen (2mg/kg) for two days after surgery. Rats were allowed a total of 10 days to recover from the surgery.

Apparatus

Context A consisted of six clear plastic observation chambers (28 X 21 X 21 cm; Lafayette Instruments). The floor of each chamber consisted of 18 stainless steel rods spaced 1.5 cm apart. The rods were wired to a shock generator and scrambler that were controlled by a programmable stimulus controller (MED-Associates, Burlington, VT). An electrical fan provided background noise during all training sessions. Before and after each training session a 5% solution of sodium hydroxide was used to wipe clean the interior of each chamber. In addition, below the rod floor of each chamber, a stainless steel pain was coated with benzaldehyde solution (5 μl/ 2 ml of 100% ETOH) as a background odor prior to each session. The chamber activities were recorded via video cameras positioned on the wall opposite each pair of chambers. The rats were recorded continuously during the training and test sessions.

Behavioral Trainings

All animals were transported to the observation chambers in their homecages. Training consisted of the delivery of 3 footshocks (0.9 mA; 2s) spaced 64 seconds apart. Two minutes following the placement of the rats in the observation chamber, the first footshock was delivered. The rats were returned to the observation chamber to measure context fear at 24 hours following the training session.

Behavioral Measures

Observation of freezing behavior was used as an index of conditional fear. Freezing was defined as the lack of movement, with the exceptions of those related to respiration. Measurements of freezing were taken from videotaped recording of each overtraining and test

session by an observer blind to the experimental condition of each rat. Freezing responses were transcribed in 64 seconds epochs every 8 seconds for each rat.

Histology and Immunochemistry

Histology.

Following training procedures, all rats were deeply anesthetized with sodium pentobarbital and intracardially perfused with a 0.9% saline solution followed by a 4% paraformaldehyde solution. The brain was extracted from the skull, placed in a 4% solution of paraformaldehyde for 1-2 days, then placed in a 30% solution of sucrose for another 1-2 days. Brains were then placed in a cryostat at 18 degrees Celsius and cut into 50 μm coronal sections. Sections that included the amygdala and the dorsal hippocampus were placed in holding wells that contained 1 X PBS (Fanselow & Poulos, 2005).

Immunochemistry.

Brain sections were washed in PBS for 5 min (3 times) on a mechanical shaker and placed in a blocking solution (10% goat serum, PBS, and 0.5% triton) for 1 hour. Sections were then placed in Neu-N antibody (1: 4000) and prepared in a 2% goat serum solution (PBS and 0.25%triton) at 4 degrees Celsius for 24 hours. Tissues were then rinsed in PBS (0.25% triton) for 15 min (4 times) and transferred to mouse anti-body IgG at room temperature for 1 hr 15 min. After the sections were rinsed in PBS for 10 min (4 times), they were placed in a solution of Avidin-Biotin-Peroxidase complex on a shaker for 1 hr. Sections were rinsed once more in PBS (6 times) and transferred into wells containing 3-3' diaminobenzidine tetrahydrochloride (Sigma) as a chromagen. Sections were free floated onto a subbed microscope slide and cover slipped.

Verification of lesions was made using Neu-N stained tissue viewed under a microscope (Carl Zeiss Inc.) magnified at 1.25 and 4 times. The region of the amygdala and dorsal hippocampus was outlined and examined for Neu-N staining. The lack of staining in this region was used as an indication of neuronal loss due to lesions performed during surgery (Fanselow & Poulos, 2005).

Results

Histology

A representation of the extent of the dorsal hippocampus lesions is shown in Figure 1. All rats had sufficient bilateral damage restricted to the dorsal hippocampus. Therefore, the distribution of animals being statistically analyzed was as follows: *Mefloquine Infusions Group,* 9; *Carbenoxolone Infusions Group,* 10; *Vehicle Group*, 16. Figure 2 shows the freezing results for all groups.

Context Test

One day following the tone and context training, the rats were returned to their original training context. Freezing responses were transcribed in 64-second epochs every 8 seconds for each rat. Figure 2 shows the mean percentage of observations spent freezing during the entire context test for each experimental condition.

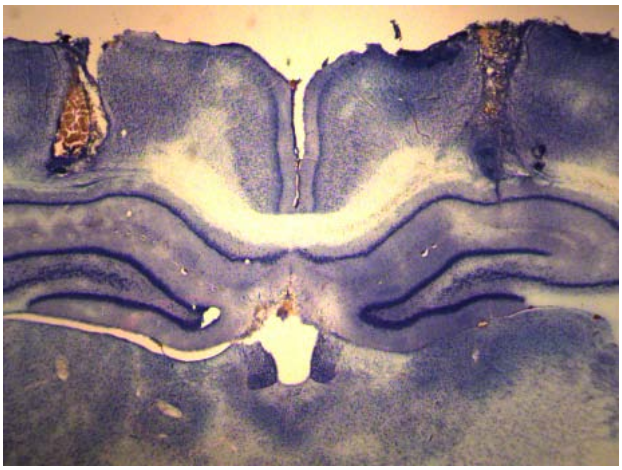


Figure 1. Histology of the dorsal hippocampus

Effect of Carbenoxolone Injection Prior to Training

Ten test rats were injected with carbenoxolone immediately before the training phase (consisting of 3 tone-shock pairings). The carbenoxolone injections proved to substantially reduce freezing to the context. Specifically, a one-way ANOVA (with variable of infusion: carbenoxolone, mefloquine, and vehicle) revealed that carbenoxolone-infused animals showed a context freezing, F (1, 9) = 24.32, $p < 0.05$ (see Figure 2).

Effect of Mefloquine Injection Prior to Training

Nine rats were injected with mefloquine immediately prior to the training phase. The mefloquine also proved to reduce freezing to the context. However, its effects were not as pronounced as the carbenoxolone injections. A one-way ANOVA revealed that mefloquine injected animals showed an average context freezing, F (1, 8) = 32.69, $p < 0.05$ (see Figure 2).

Freezing of Vehicle/Vehicle Animals

The 16 Vehicle rats were injected with a vehicle infusion prior to the training phase. The Vehicle rats showed freezing levels similar to rats that did not undergo perfusions. In particular, a one-way ANOVA revealed the vehicle rats had an average context freezing, F (1, 15) = 72.81, $p < 0.05$. Furthermore, there was no reliable interaction between test tone and surgery. A priori planned comparisons ($p < 0.05$) between vehicle and lesion animals for each training condition did not reveal a significant difference for any of the training parameters used (see Figure 2).

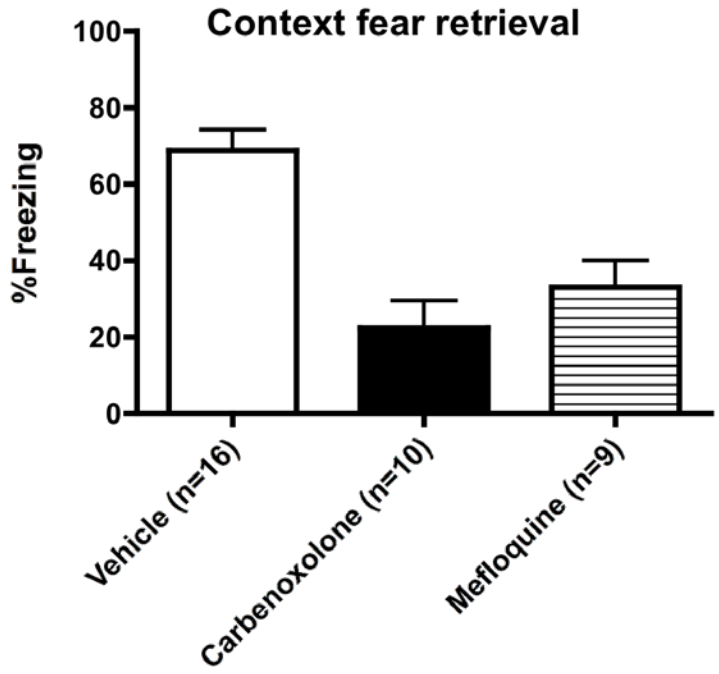


Figure 2. Freezing results for all three groups.

Discussion

The data indicate that normally, neuronal activity in the dorsal hippocampus, as controlled by electrical synapses, supports fear learning of the context in which fear memories are formed. Using fear conditioning as a behavioral read-out, we started to investigate the effects of pharmacological modulation of gap junction function on fear learning and memory processes. Our findings revealed that pre-training systemic injections of the general gap junction blockers carbenoxolone and mefloquine, potent blockers of the connexin-36 protein subunits of the gap junctions, specifically interfered with hippocampal-dependent aspects of fear conditioning.

The present results specifically demonstrate that blocking electrical synapses via pharmacological infusions directed towards the binding of the synaptic gap junctions significantly reduces the formation of fear memories to the context in which the training occurs. These results suggest that gap junctions, specifically the neuronal gap junctions containing connexin-36, can modulate hippocampal function and its involvement within the fear circuitry. The context fear retrieval is impaired in the drug groups as compared to the vehicle group, indicating that electrical synapses do play a role in the formation of fear memories. This is one of the first behavioral bodies of evidence that supports a role for gap junctions in behavior and fear learning and memory.

Future studies should look at context fear acquisition and extinction curves in order to get a more holistic view on the role electrical synapses play in fear memories. The results in this study suggest that one would find slower acquisition and faster extinction of fear in animals infused with gap junction blockers, as blocking the synapses seems to inhibit fear memories to the context. Studies revealing these trends would further support our hypothesis that gap

junctions modulate the fear circuitry specifically through their roles in synchronizing hippocampal function.

These results have implications for major fear related disorders such as PTSD. Essentially, this study could be expanded into future studies that would eventually create a drug specifically targeting gap junctions in the brain in order to prevent the occurrence of fear-related disorders before they occur. The drugs would be given prior to the fear-learning situation (similar to the training phase in this study) and subsequent fear-related behaviors such as flashbacks (similar to freezing in this study) would be reduced. Obviously, these drugs could only be issued in situations where fear-provoking memories would be predicted, such as in the battle context during war periods. Administering gap junction blockers as a treatment to PTSD holds the possibility of inhibiting some reflexive behaviors if not administered to specific gap junctions (Bennett, 1997). However, addressing these specificity issues could render giving soldiers pre-war medication an important and effective practice in reducing PTSD occurrences in veterans returning from wars.

References

Belluardo, N., Mudo, G., Trovato-Salinaro, A., Gurun, S. & Charollais, A. (2000). Expression of connexin36 in the adult and developing rat brain. *Brain Research, 865*, 121-138.

Bennett, M.V. (1997). Gap junctions as electrical synapses. *Journal of Neurocytology, 26*, 349-366.

Carlson, Neil R. (2007). *Physiology of Behavior* (9th ed.) (pp. 439-484). Needham Heights, MA: Pearson Education, Inc.

Fanselow, M. S. & LeDoux, J. E. (1999). Why we think plasticity underlying Pavlovian fear conditioning occurs in the basolateral amygdala. *Neuron, 23*, 229-232.

Fanselow, M. S. & Poulos, A. M. (2005). The neuroscience of mammalian associative learning. *Annual Review of Psychology, 56*, 207-234.

LeDoux, J. E. (1993). Emotional memory systems in the brain. *Behavioural Brain Research, 58*, 69-79.

Maren, S. (2001). Neurobiology of Pavlovian fear conditioning. *Annual Review of Neuroscience, 24*, 897-931.

Martin, F. C. & Handforth, A. (2006). Carbenoxolone and Mefloquine Supress Tremor in the Harmaline Mouse Model of Essential Tremor. *Movement Disorders, 21*, 1641-1649.

Raineki, C. & Holman, P.J. (2009). Functional Emergence of the Hippocampus in Context Fear Learning in Infant Rats. *Hippocampus, 15*, 417-432.

Smith, D. M. & Mizumori, J. Y. (2006). Hippocampal Place Cells, Context, and Episodic Memory. *Hippocampus, 16*, 716-729.

EXTRA VISUAL ENCODING TIME ENHANCES SEMANTIC REPRESENTATION

Sophia Chim
University of California, Los Angeles

Abstract

People are able to visually and conceptually process complex images at rates above 8/sec. At these rates, participants can form fleeting memories of the pictures in very short-term memory (VSTM). In this study, we investigated the effects of image processing time on conceptual versus perceptual information in VSTM. To differentiate between perceptual and conceptual components, we tested with decoys (images conceptually similar but visually distinct from the original image). To determine the effects of image processing, we kept image presentation time constant and manipulated inter-stimulus-interval (ISI) and delays. The resulting three conditions were 1 image/s with 173 ms with 827 ms ISI, 173 ms with no ISI, and 173 ms with no ISI but a 5.26 s delay. Surprisingly, participants were worse at rejecting decoy foils when given longer processing time while image presentation time was kept constant. Thus, the duration of image processing rather than that of image presentation determines whether conceptual representations supersede visual ones in VSTM.

Introduction

Our world contains a great deal of visual information. Visual information is taken in by successive fixations that are separated by brief saccades; thus presentation of still images at quick durations mimics the circumstances under which people normally encode visual information every second of every day (Potter, 1999). Normal eye fixations are approximately 125 to 333 ms. How do people take in whole scenes of the world when their eyes move so quickly from one object to the next? To perceive a complex scene, a person must saccade to the objects of interest, thus making visual processing of scenes a serial task (Henderson & Hollingworth, 1998). A person must accumulate each single representation to form a final complex scene (Hollingworth & Henderson, 2002). However, in experimental settings, most briefly-presented images are forgotten when tested shortly after presentation (Potter & Levy, 1969).

An example of this rapid forgetting is the phenomenon of change blindness. It occurs when a person fails to detect a change between two versions of the same image that alternates on the screen every few seconds. Studies have shown that a subject's ability to detect changes between altered images is poor because subjects tend to focus on the semantic object in an image instead of the whole image (McConkie & Currie, 1996). Rensink et al. (1997) developed a "flicker" paradigm to induce change blindness and found that our attention allocates to semantically informative regions of the scene first. Studies have illustrated that subjects process the general gist in early viewing of an image and this knowledge can be used to guide attention and gaze (Henderson, 2003). Thus, schematic and higher order (top-down) information inhibits lower order (bottom-up) information that is necessary for detecting peripheral change (Johnston & Hawley, 1994). The same reasoning can explain boundary extension, a phenomenon in which subjects extend the boundaries of objects viewed at the test phase, recalling parts of objects not visible in the actual image (Intraub, Bender, & Mangels, 1992). In essence, both phenomena demonstrate that semantic information may supersede visual information in short-term visual representations.

Potter, Staub, and O'Conner (2004) proposed that there are two types of very short-term memory for scenes: pictorial short-term memory (PSTM) and conceptual short-term memory (CSTM). Memory reliance on visual features such as color, shape, novel patterns, object orientation, and nongist pictorial information characterizes PSTM (Potter, Staub, & O'Conner, 2004). On the other hand, memory reliance on gist information or conceptual content characterizes CSTM (Potter, Staub, & O'Conner, 2004). A pictorial test that used a yes-no recognition test for old pictures mixed with new pictures provide both visual-pictorial and conceptual information, relying on both PSTM and CSTM (Potter, Staub, & O'Conner, 2004). CSTM was elicited when a serial presentation of meaningful stimuli triggered the access of semantic information and associations for each stimulus (Potter, 1999). CSTM was affected when there was no opportunity for linking the unrelated images into a structure, leading to high loss rates for serial images (Potter, 1999). CSTM can be demonstrated when a new scene replaced the previous one and little survived from the previous glimpse that can be compared with the present scene, other than the gist (Potter, 1999). In rapid sequential visual presentation (RSVP) experiments, conceptual structure was found early in processing, before the conventional short-term memory had been established. This demonstrated that CSTM was separate from short-term memory and working memory (Potter, 1999). Potter, Staub, and O'Conner (2004) proposed that PSTM and CSTM coexist initially, but PSTM was lost as early as two to three seconds while CSTM lasted for approximately five to six seconds. Therefore, CSTM is left as the main basis of short-term recognition later in testing.

Potter, Staub, and O'Conner (2004) used decoys images at test. Decoys are conceptually similar but visually distinct from the target image. Decoy images were used to evaluate the conceptual basis of memory for images presented for 173 ms each. If subjects rely on visual match then they should not be susceptible to decoys. However, if they rely on CSTM, they should commit more false positives for decoys than for new distracters that are not conceptually similar to prior targets. They found that subjects made significantly more false positives to decoys than to novel distracters; however subjects made less false positives to decoys than genuine targets. Therefore, the subject's representations of the images included enough visual information to allow the subject to reject some of the decoys. At this presentation rate, gist information was not all that is retained from sequential, conceptually-masked images; visual detail was remembered as well. Gist was the basis for initial retrieval of recognition of an image

but additional information including the visual information was also recalled (Potter, Staub, & O'Conner, 2004).

The performance on decoys was only tested at the rate of one image per 173 ms in Potter, Staub, and Conner's study (2004). However, it is important to know how the time given to view or process an image may affect the retention of conceptual and visual detail of a presented image. In this study, we explored the effects of image processing time on decoy performance by varying the subjects' time to encode images. Therefore, we can ask whether a longer image processing time allow subjects to process more perceptual or conceptual information. To measure the effect of image-processing time, image presentation time was kept constant whereas inter-stimulus-interval (ISI) was either included or excluded in conditions. The presence of ISI allowed extra image encoding time or greater image-processing time. Therefore, the variables that were manipulated in this experiment were ISI and delay duration. While keeping image presentation duration constant at 173 ms, we manipulated ISI (0 ms vs. 827 ms) and delay duration (0 s vs. 5.26 s) within-subjects, across learning blocks. The presentation duration was kept constant at 173 ms to be consistent with Potter, Staub, and Conner's study (2004), whose earlier work showed that at 173 ms, most pictures can be identified during presentation, but more than half cannot be recognized when memory is tested a minute or two later. The ISI was manipulated at 827 ms because at ISI of 827 ms and presentation duration of 173 ms, the stimulus onset asynchrony (SOA) was 1 s, again consistent with Potter, Staub, and Conner's study (2004). This resulted in three conditions. The dependent variable measured was the amount of false positives made in decoys versus non-decoys. This resulted in a 3 x 2 within subjects design.

There are three possibilities in subjects' performance in responding to the decoys when given more processing time. Subjects may show less false positives, the same number of false positives, or more false positives in detecting decoys. If subjects yield less false positives in detecting decoys when given more processing time, then subjects are gaining more perceptual information to differentiate between decoys. If subjects yield the same number of false positives, then the extra processing time has no effect on perceptual or conceptual information. If subjects yield more false positives, then subjects are gaining more conceptual information. If these decoys deceive subjects, yielding more false positives, it would suggest that the ratio of conceptual to perceptual information only increased with longer processing time. The results of this study have implications for how we process the natural visual world.

Methods

The twenty-one subjects in this study were University California, Los Angeles (UCLA) undergraduate students that participated in this experiment for class credit. All subjects had normal or corrected-to-normal vision. Each subject was tested in all experimental conditions in a single testing session.

The images were gathered from free use Internet databases. These pictures consisted of animals, people engaged in various activities, nature scenes, and city scenes. They were presented on an IBM PC computer. The color images were 25 x 25 cm square pictures presented on a gray background. The images were presented at a 21.3 degrees visual angle in each direction at a standard viewing distance of 64 cm between the participant and computer screen. The lights in the room were turned off so that the subject could fully focus on the images presented on the computer screen.

This experiment was broken into 45 trial blocks. Each trial block was separated by a gray screen, which would automatically display after a trial block was completed. Each trial block consisted of an encoding phase and recognition or test phase. The encoding phase consisted of six encoding images; the sixth image was a visual mask and was not tested. The recognition phase, also known as the test phase, consisted of ten test images. The ten images in the recognition phase of each trial block consisted of four targets from the encoding phase, five new distracter foils that were not conceptually similar to any of the pictures they had just seen (foil), and one visually different "decoy" image (decoy) that occupied the test position of the untested target image. Target, foil, and decoy images were arranged in random serial order in the recognition phase of each trial block.

Each trial block consisted one of the three conditions in this experiment. The three conditions differed in their ISI and delay durations. ISI was a blank screen that appeared for 827 ms between encoding images. ISI was analogous to "gaps" or slight pauses of a blank screen before a new encoding image appeared after the previous encoding image. Delay durations consisted of a blank screen for 5.26 s after the encoding phase or before the recognition phase began.

The first condition, Condition with ISI and no delay, had an encoding phase that presented each image for 173 ms with 827 ms ISI. The second condition, Condition no ISI and no delay, had an encoding phase that presented each image for 173 ms with no ISI. The third condition, Condition no ISI and with delay, had an encoding phase that presented each image for 173 ms with no ISI but a 5.26 s delay between the encoding phase and recognition phase. The sum of the delay duration and the amount of time the images were shown in Condition no ISI and with delay is equal to the sum of ISI and the amount of time the images were shown in Condition with ISI and no delay. Therefore, the time between the first image shown in the encoding phase and the first test image in the recognition phase in these two conditions was equal. These three particular conditions were tested so that Condition with no ISI and no delay was consistent with Potter, Staub, and O'Conner's study (2004). Condition with ISI and no delay was tested to keep the image presentation time constant with Condition with no ISI and no delay but manipulated the time to process the images. Therefore, Condition with ISI and no delay can determine whether the decoy effect is due to limited processing time during the encoding phase. Condition with no ISI and with delay was tested to differentiate whether any decoy effect in Condition with ISI and no delay may be attributed to the differential decay of visual and conceptual short-term memory over time.

The gray screen that automatically displayed after the completion of each trial block indicated the encoding phase duration for the next trial-block. For example, before beginning a trial block, the screen displayed "Gaps" for Condition with ISI and no delay. Whereas, the screen displayed "No Gaps" for Condition no ISI and no delay and Condition no ISI and with delay. However, the participants were not informed whether there would be a delay, therefore subjects did not know in advance whether the trial was Condition no ISI and no delay or Condition no IS and with delay. The subject pressed the space bar to begin each trial block.

After the encoding phase, the participants saw a gray screen with a white square for 293 ms, which they were told that it indicated the end of the encoding phase and the beginning of the recognition phase, followed by 10 test images. Test images in the recognition phase were each shown for 400 ms, followed by a blank, gray screen.

Before the experiment began, each participant was read a series of instructions. They were told to decide whether each test image in the recognition phase was identical to the

previous encoding images in the trial block by pressing the left key to indicate "yes' and the right key to indicate "no". Participant responses were self-paced, but they were told to respond as quickly and accurately as they could. They were also informed that no images appeared in more than one trial block. They were not informed of the presence of decoys. Each subject completed three practice trials to ensure that they understood the task. The three practice trials were examples of each of the three conditions tested in the experiment. Subjects were permitted to take a brief break to stretch or blink between trial blocks.

The decrement in performance on decoys, or the Decoy Effect, was quantified based on the difference in performance for non-decoy foils and decoy foils. In this measure, subject's responses in correctly identifying foils and decoys are true negatives (TN). The subtraction measure, Accsub, was used to quantify the Decoy Effect and was calculated by [P(TN of Non-decoy Foils) - P(TN of Decoys)].

In a separate analysis, we assessed subjective visual similarity between images and their paired decoys. Judgments of visual similarity were determined by the agreement of two individual experimenters. Each pair was evaluated separately for their color and shape similarity.

Results

Overall performance across all trials is shown by condition in Figure 1. Repeated-measures 1 x 3 ANOVA revealed a significant effect of condition on overall accuracy (F-113, $p< 1x\ 10^{-14}$). Paired t-tests revealed that Condition with ISI and no delay decoy accuracy was greater than Condition no ISI and with delay ($p< 1x\ 10^{-10}$), which in turn was greater than Condition no ISI and no delay ($p<0.0001$).

A 2 x 3 repeated-measures ANOVA was used to test the effects of timing condition and foil type (decoy or non-decoy). Figure 2 illustrates the significant main effects of foil type ($F=312$, $p<1x10^{-12}$) and of timing condition ($F=42$, $p<1x10^{-7}$), as well as a significant interaction between foil type and condition ($F=25$, $p<1x10^{-5}$).

Posthoc paired t-tests revealed lower performance on decoy foils than non-decoy foils (all three conditions $ps<1x10^{-6}$). Among non-decoy foils, performance was better in Condition with ISI and no delay than Condition no ISI and no delay and Condition no ISI and with delay (both $ps<0.002$). Conditions no ISI and no delay and Condition no ISI and with delay were not significantly different ($p=0.054$). However, this pattern was different for decoy images. Performance on Condition no ISI and with delay was better than Condition no ISI and no delay ($p<0.0001$), which in turn was better than Condition with ISI and no delay ($p<0.005$).

A 1 x 3 repeated-measures ANOVA was conducted the Accsub measure of the magnitude of the Decoy Effect for the three timing conditions. Figure 3 illustrates the significant effect of condition on Accsub ($F=42$, $p<1x10^{-7}$). Posthoc paired t-tests revealed significant differences in the magnitude of the Decoy Effect between each of the three conditions (all $ps<0.0001$). The magnitude of the Decoy Effect was greatest in Condition with ISI and no delay and least in Condition no ISI and with delay.

Figure 1

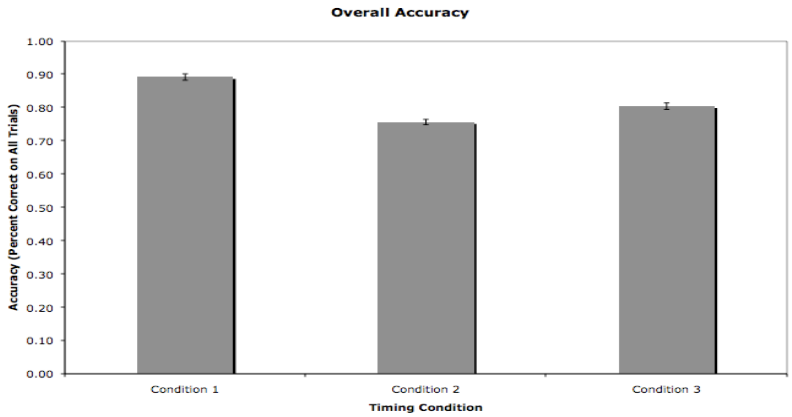


Figure 2

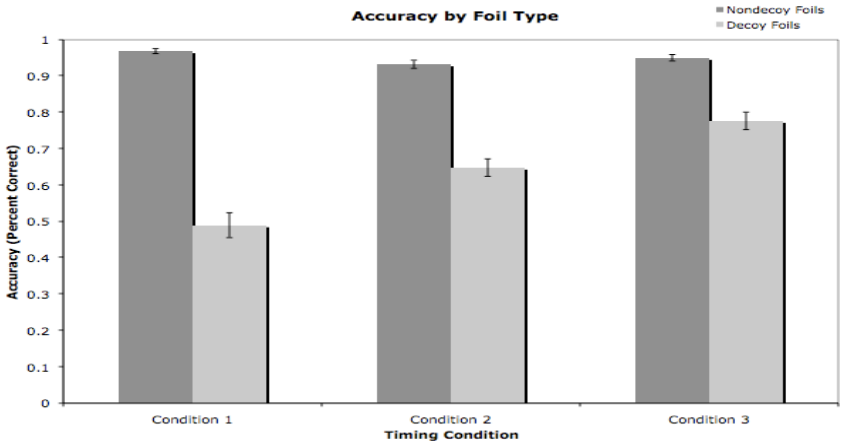
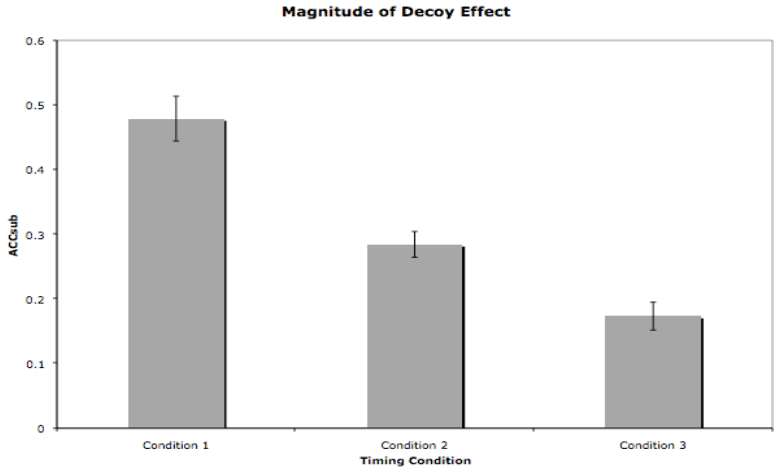


Figure 3



Repeated-measures 2 x 3 ANOVA was conducted on decoy accuracy for the differences in decoy shape similarity by condition. Figure 3a shows no main effect of decoy shape similarity on decoy accuracy ($F=0.03$, $p=0.35$), but there was a significant main effect of condition ($F=26$, $p<1x10^{-6}$). There was also a significant interaction decoy shape similarity and condition on decoy performance ($F=8.5$, $p<0.001$).

A separate 2 x 3 repeated-measures ANOVA was conducted on decoy performance by decoy color similarity and condition. Figure 3b illustrates both a significant main effect of decoy color similarity ($F=60$, $p<1x10^{-6}$) and of condition ($F=31$, $p<1x10^{-6}$) on performance. There was no significant interaction between decoy color similarity and condition ($F=1.4$, $p=0.25$).

Figure 3a

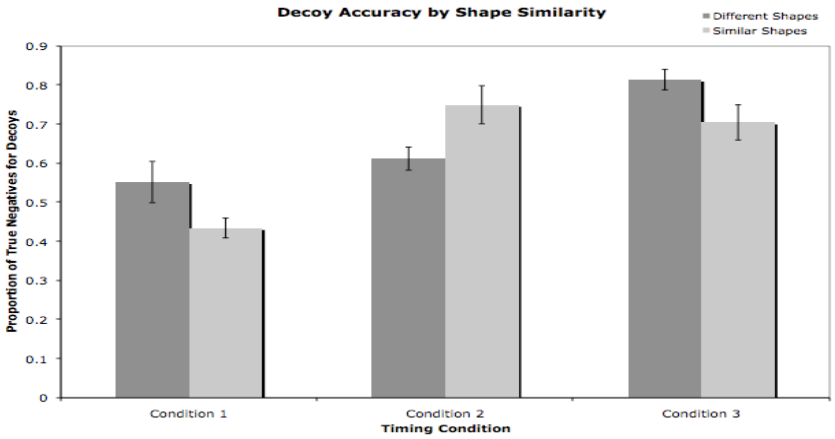
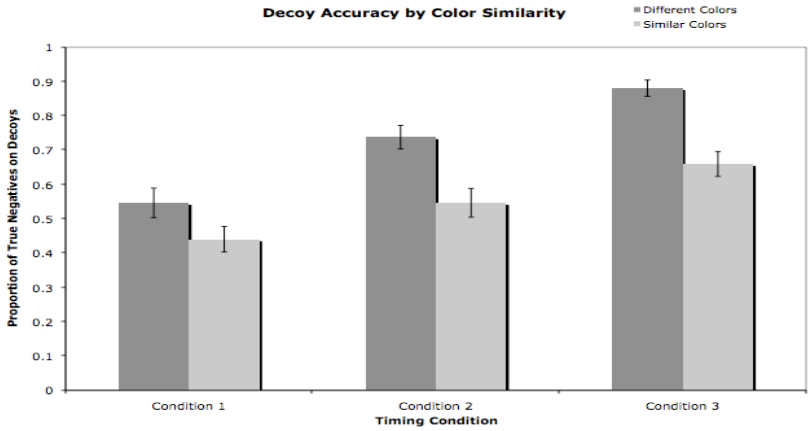


Figure 3b



Discussion

This experiment investigated how image-processing time might affect the retention of conceptual and visual details of the image. In this study, we varied the time subjects had to encode and process images, while keeping the viewing time the same. In addition, we included the third condition, Condition no ISI and with delay, that included a delay to differentiate whether the Decoy Effect can be attributed to the delay of visual and conceptual information

over time. By varying the processing time, we could test whether additional time to process an image at encoding disproportionately promotes CSTM or PSTM.

In all three conditions, subjects tended to fall for decoy foils more than non-decoy foils. Condition no ISI and with delay showed significantly better identification of decoys, therefore, less of a Decoy Effect, than Condition with ISI and no delay and Condition no ISI and no delay. Since Condition no ISI and with delay allowed the same amount of consolidation time of images and decoys as Condition with ISI and no delay, the results indicate that the sizable Decoy Effect in Condition with ISI with no delay is not due to a disproportionate decay of visual information over the delay to test. Therefore, the increased Decoy Effect in Condition with ISI and no delay compared to Condition no ISI and no delay is due to the additional processing time during encoding. Surprisingly, subjects performed rather poorly and reflected a strong Decoy Effect in Condition with ISI and no delay. We had expected that if subjects were given greater processing and encoding time, they would have been able to retain more visual information and shown a reduced Decoy Effect. Subjects were largely relying on semantic information regardless of the amount of processing time given at encoding. Therefore, we conclude that extra scene encoding time enhances conceptual processing and reinforces a semantic representation *to the detriment* of a visual representation.

Our natural view of the world is composed of successive fixations that allow visual information to fade as quickly as it is processed. Extending the amount of time people can view images and scenes, by allowing longer fixations, should provide greater visual information processing. However, we have shown that extra processing time at encoding does not enhance visual information; rather, it strengths conceptual information.

In the real world of changing viewpoints and locations, visual properties of an image can change greatly from one fixation to the next whereas semantic information is largely consistent. People must attend to the meaningful items in an image or scene, removing excess visual information to allow greater integration of information across successive fixations. Therefore, our findings make sense in the context of real-world scene processing. Humans are efficient of retaining consistent and relevant (semantic) information and discarding everything else.

References

Henderson, J. M. (2003). Human gaze control during real-world scene perception. *Trends in Cognitive Sciences, 7,* 498-504.

Henderson, J. M. & Hollingworth, A. (1998). Eye movements during scene viewing: An overview. In G. Underwood (Ed.), *Eye guidance in reading and scene perception* (pp. 269-283). Oxford, England: Elsevier.

Hollingworth, A., & Henderson, J. M. (2002). Accurate visual memory for previously attended objects in natural scenes. *Journal of Experimental Psychology: Human Perception and Performance, 28,* 113-136.

Intraub, H., Bender, R. S., & Mangels, J. A. (1992). Looking at pictures but remembering scenes. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 18,* 180-191.

Johnston, W. A., & Hawley, K. J. (1994). Perceptual inhibition of expected inputs: The key that opens closed minds. *Psychonomic Bulletin and Review, 1(1),* 56-72.

McConkie, G. W., & Currie, C. B. (1996). Visual stability across saccades while viewing complex pictures. *Journal of Experimental Psychology: Human Perception and Performance, 22,* 563-581.

Potter, M. C. (1999). Understanding sentences and scenes: The role of conceptual short term memory. In V. Coltheart (Ed.), *Fleeting memories* (pp. 13-46). Cambridge, MA: MIT Press.

Potter, M. C., & Levy, E. I. (1969). Recognition memory for a rapid sequence of pictures. *Journal of Experimental Psychology, 81,* 10-15.

Potter, M. C., Staub, A., & O'Conner, D. H. (2004). Pictorial and conceptual representations of glimpsed pictures. *Journal of Experimental Psychology, 30,* 478-489.

Rensink, R. A., O'Regan, J. K., & Clark, J. J. (1997). To see or not to see: The need for attention to perceive changes in scenes. *Psychological Science, 8,* 368-373.

THE EFFECTS OF CAREGIVERS' PRESENCE ON CHILDREN'S EXPLORATIONS

Dezryelle M. Arcieri, Sze Chai Ching, Ka Yee Lui
University of California, Los Angeles

Abstract

This study examined the effect of children's age and the presence of their caregivers on their exploratory behaviors, based on past findings that suggested a positive correlation between the presence of caregivers and effective exploration and academic success. Using naturalistic observations at a museum, the researchers conducted two studies to test these effects. Study 1 recorded the length of time the observed children explored an exhibition with or without caregivers present within a 3-feet proximity zone. Results indicated that children with caregivers present spent a significantly longer time exploring the exhibition than those without. In Study 2, the researchers examined how children's age affected their exploration with or without the presence of their caregivers. Statistical analyses revealed a significant main effect for both the presence of caregivers and the age of the children. Findings thus showed that the presence of caregivers was related to an increase in the time the children spent exploring.

Introduction

Research has shown that parental involvement is influential to a child's academic success. In fact, the role of parents is so consequential that the U.S. Department of Education specifically stated in the No Child Left Behind Act that they need to make a consorted effort in their children's education in order to promote academic success (2004). Zellman and Waterman (1998) argued that a child's academic success can be attributed to the amount of time and nature of parent-child interactions. Also, a child's level of interest, obtained through the help of parents, is related to successful learning in school (Marjoribanks, 2005). It is apparent that parental involvement, especially in educational activities, is paramount to children's learning,

and this study seeks to examine whether such results can be extrapolated to a natural learning environment—specifically, a science museum.

There is strong evidence that parental involvement is positively correlated with school readiness (Connell & Prinz, 2002), children's reading abilities, as well as a diminishment in childhood learning problems (Zellman & Waterman, 1998). In addition, research findings suggest that parental involvement at home is equally as important (Christenson, Rounds, & Gorney, 1992). In fact, such involvement can be exerted in many different ways—through parent expectations, structure of the home environment, discipline, school-home communication, school involvement, and decision-making in schools; among others (Christenson et al., 1992). Consequently, the more involved a parent is in an array of activities in and outside of the school system that support education, the more likely the child is to succeed.

Museums, for example, are popular places for children and families to visit and have been shown to be important in the study of cognition and exploration (Schofield-Bodt., 1987). In previous studies, researchers have chosen museums as a suitable informal learning context to examine how children's learning can be facilitated effectively there (Henderson, Charelesworth, and Gamradt, 1982; Schofield-Bodt, 1987). For example, Henderson et al. (1982) museum research found that children were more likely to stay engaged at any one exhibit when they were in the presence of their parents as opposed to their peers. In a subsequent study, Henderson (1984) found that this is due to the level of knowledge, structure, and support that parents were able to provide their children with during their exploration. Henderson (1984) argued that parental involvement at a museum can assist in the development of learning processes for children. Indeed, children's perceptions and opinions about the topics under study tend to become more refined after museum explorations, testifying to how such experiences can enhance their learning (Melber., 2003). Research showed that children could gain much knowledge from exploring museum exhibitions, and that this could translate into academic benefits in future (Melber., 2003).

Measuring the level of engagement between parent and child is a difficult task. However, Sandifer (1997) suggested that the time parents and children spend at a museum exhibit could be an effective measure of the extent of learning in children. Crowley et al. (2001) also used this measure in their study and found that children spent a longer time observing and manipulating the museum exhibits when their parents engaged them in conversation about the exhibits. They attributed their findings to the fact that parents could assist their children with structure, goals, and motivation to explore and learn about novel objects. Moreover, they found that children demonstrated a greater understanding of those exhibits when their parents discussed the relevant scientific topics with them. While the aforementioned studies analyzed the quantity and quality of parent-child interactions, due to study constraints, we decided to focus specifically on whether the caregivers' presence and proximity to the children play a significant role in increasing the amount of time children spend exploring novel objects. Hence, we measured the length of time that children took to explore a museum with or without their caregivers present, with the hypothesis that children in the company of their caregivers will spend more time exploring a museum than those without their caregivers. We tested these effects in a preliminary study (Study 1), then reproduced these effects with a follow-up study (Study 2), that additionally examined the effects of children's age on their exploratory patterns.

STUDY 1

Based on previous research, in this study we measured whether the presence of caregivers affected the length of time children spent exploring a museum exhibit. Instead of recording the nature of parent-child interactions, as has been done in previous studies, we used unobtrusive, naturalistic observations to test these effects.

Methods

Participants

This study sampled a total of 38 children randomly selected from the California Science Museum in Los Angeles. Out of them, 16 were male and 22 were female. They were estimated to range from 3 to 10 years old. 17 participants were identified as *with caregiver* and 21 participants, *without caregiver*.

Design

All participants were observed naturalistically as they explored a designated exhibit at the museum. All were unaware they were being recorded for the purpose of the study. As aforementioned, they were placed into one of the two conditions, *with caregiver* or *without caregiver*, based on their caregivers' proximity to the museum exhibit they were exploring. We defined a *proximity zone* (see Figure 1) as approximately 3 feet away from the exhibit. If a child and his/her caregiver were both within the proximity zone to the exhibit, the child was defined as *with caregiver*. In addition, to qualify for this condition, the caregiver must enter the proximity zone within 10 seconds after child entered it. For example, if a child entered the proximity zone, and his or her caregiver entered the proximity zone five seconds after the child touched the exhibit, then it would be classified as a *with caregiver* condition. Also, for easier comparative purposes, if a child was classified as such, but his/her caregiver subsequently moved out of the proximity zone for 10 seconds or more when he or she was still inside it, then this case would be excluded from the study. On the other hand, if a child was inside the proximity zone surrounding the designated exhibit, while his/her caregiver was three or more feet away from the exhibit (i.e. outside proximity zone), it would be classified as a *without caregiver* condition. Similar to the aforementioned restrictions, if a child was categorized under the *without caregiver* condition, but his/her caregiver entered the proximity zone 10 seconds or more after he/she touched the exhibit, this case would be excluded from the study too.

Materials

We observed children's exploratory patterns at a hands-on exhibit at the museum that demonstrated how to build strong structures using blocks and pegs, as shown in Figure 1. The exhibit itself consisted of two large wooden boxes approximately two feet away from each other. These wooden boxes had uniform rows of small holes all around them. The holes held the pegs that could be inserted into them to create a structure. Small round blocks, which had more small holes, were connected to the end of the pegs as a link for more and more pegs. The objective of the exhibit was to use the pegs and small blocks to create one large structure that connected the

two large wooden boxes. We chose this hands-on exhibit because it required viewers to manually manipulate the provided materials, which would clearly point to an active engagement in exploration and learning. We used stopwatches to record the time the children spent in exploring the exhibit (in minutes and seconds)

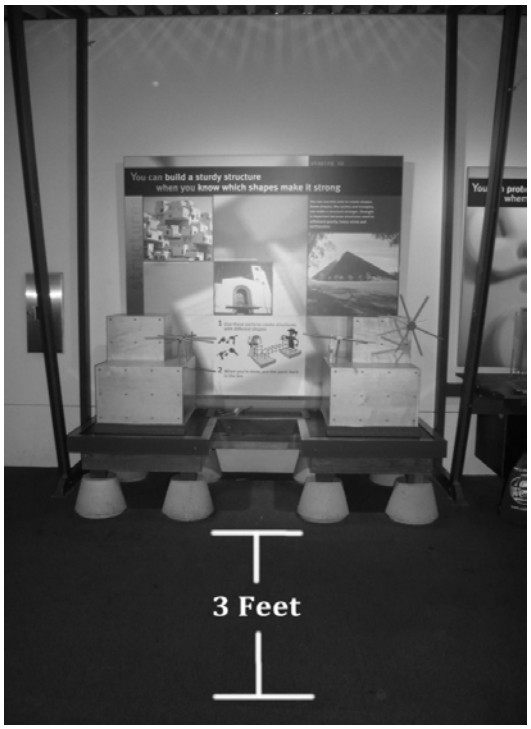


Figure 1. A photograph depicting the structure of the exhibit, which includes two large wooden boxes with holes, pegs and connecting blocks, as well as the 3-feet proximity zone designated.

Procedures

Data was recorded from the other side of the room in order for researchers to stay inconspicuously out of the subjects' sight. Researchers started the stopwatch once a child entered the proximity zone and touched the provided blocks or pegs at the designated exhibit. Cases in which the child was within the zone but never touched the exhibit materials were excluded. At the same time, with regard to the proximity of the caregivers, the child is classified to be in the *with caregiver* or *without caregiver* condition. The caregivers simply had to be either inside or outside the proximity zone; their interaction with any part of the exhibit materials was not considered in this study. Once the child stepped out of the proximity zone after exploring the exhibit, the researchers would stop timing. Each subject was observed and recorded by two researchers at the same time to ensure greater reliability. Also, data collection duties were assigned each researcher on a rotating basis to eliminate any possible bias effect.

Results

We sought to investigate whether children would spend more time exploring an exhibit with or without their caregivers. We found that children classified as *with caregivers* spent a mean time of 373 seconds exploring the exhibit, while those categorized as *without caregiver* spent a mean time of 74 seconds in exploration (see Figure 2). Also, the longest time a child spent in exploration in the presence of their caregivers was 36 minutes and 21 seconds (2181 seconds), while the longest time a child spent in exploration without caregivers was 7 minutes and 6 seconds (426 seconds). A t-test confirmed that children with caregivers spent significantly more time exploring an exhibit than those without caregivers, t (36) = 2.49, p = .018. These results indicate that the presence of caregivers does have an effect on the extent of children's exploratory activities.

Previous studies found that caregivers often direct, instruct, and explain to their children as they interact with the latter, facilitating the latter's learning (Crowley et al., 2001; Henderson et al., 1982). We observed that most of the caregivers did interact with their children and explored the exhibit together with them. This might be one of the reasons why children with caregivers spent a longer time in exploring the exhibit. With help and instructions from their caregivers, children might have understood and showed more interest in the exhibit, which lengthened their stay around it. We also observed that children with caregivers were willing to spend a longer time at the exhibit even when their caregivers did not interact with them at all. Thus, another explanation could be that children are simply socialized to stay with their caregivers when in an unfamiliar environment. Children with caregivers may have felt more secure at the exhibit when their caregivers were accompanying them, hence accounting for their lengthened stay in the vicinity even without any input from the caregivers.

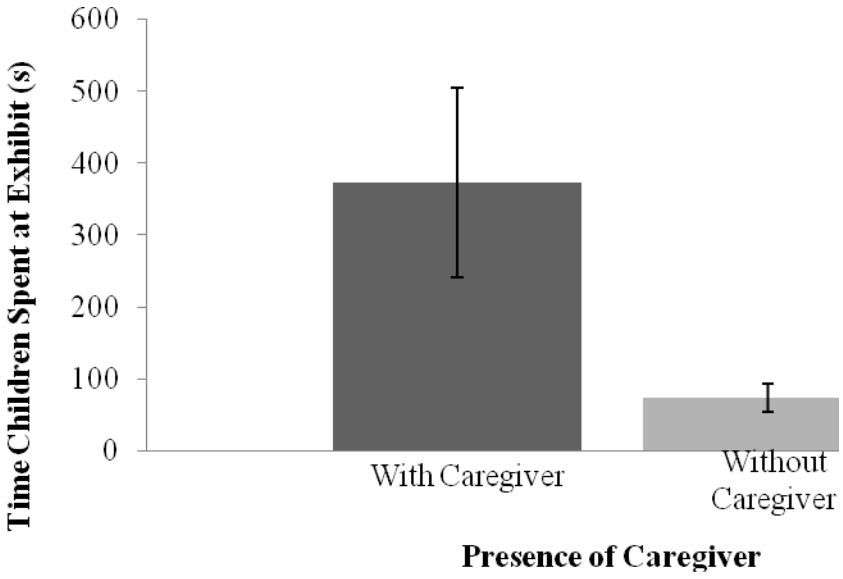


Figure 2. Mean time children spent in exploring the exhibit according to the presence of caregivers. Error bars represent standard error.

STUDY 2

Considering the possibility that the results yielded by Study 1 may be attributed to some other age-related factor, (e.g. attention span), we sought to investigate if age had any effect on the length of time the children spent in exploration, with or without their caregivers present. A previous study by Henderson et al. (1982) showed that preschool-aged children tended to spend a longer time interacting with adults at a museum exhibit than school-aged children. The researchers suggested that this finding was due to the efficiency of school-aged children in information-processing, as they were able to extract meaning from the exhibits at a faster rate than the preschool-aged children. However, other researchers suggested that children's attention span would increase with age (Ruff & Lawson, 1990), implying that older children may spend a longer time at an exhibit in comparison to the younger children. Hagen and Hale (1972) suggested that as children develop, they can better attend to important information and ignore unimportant information, thereby refining their learning skills. In the light of these propositions, we examined in Study 2 not only the presence of caregivers but also the effects of age on the duration of exploration, to determine whether a correlation existed. For the purpose of this study, we estimated the ages of the children in a manner similar to Hall and Veccia (1990), who showed that researcher's age estimations tended to be both reliable and unobtrusive.

Methods

Participants

This study sampled a total of 88 children approximately between ranging from 3-10 in age. Out of them, 51 subjects were assigned to the *with caregiver* condition and the remaining 37, the *without caregiver* condition. Each subject was also placed into one of three groups based on their estimated age, the *3-4 group*, *5-7 group*, or *8-10 group*. In the *3-4 group*, there were 18 subjects (12 boys, 6 girls) with caregivers and 11 subjects (3 boys, 8 girls) without caregivers. In the *5-7 group*, there were 17 subjects (9 boys, 8 girls) with caregivers and 15 subjects (6 boys, 9 girls) without caregivers. Lastly, in the *8-10 group*, there were 16 subjects (11 boys, 5 girls) with caregivers and 11 subjects (8 boys, 3 girls) without caregivers. All subjects were randomly selected for observation in the California Science Museum in Los Angeles, California.

Design

All subjects were observed naturalistically at the same exhibit as in Study 1. The assignment of the *with caregiver* and *without caregiver* conditions, the designation of the proximity zone, and criteria for exclusion all remained the same. The only change incorporated was an additional estimate of the age of the children.

Materials

Materials consisted of the same items as used in Study 1—the hands-on exhibit and stopwatches.

Procedure

All procedures were the same as with Study 1, except that the researchers also needed to record the approximate age of children now.

Results

We conducted a two-way between-subject ANOVA to examine the effects of children's age on the time they spent in exploring the museum exhibit, with or without their caregivers present. As can be seen from Figure 3, first, a main effect for the presence of caregivers was found, regardless of the age of the children; children with their caregivers spent a significantly longer time at the exhibit (M = 214.58, SD = 266.44) than those without (M = 81.68, SD = 141.88), $F(1,82) = 8.64$, $p < .05$. The results also revealed a main effect for children's age, $F(2,82) = 5.72$, $p < 0.05$. Children in the *8-10 group* spent the longest time at the exhibit (M = 261.5, SD = 212.6), followed by the *3-4 group* (M = 125.1, SD = 216.8), and lastly the *5-7 group* (M = 80.3, SD = 211.4). To test for any significant difference between the age groups, three independent t-tests were conducted. The *8-10 group* spent a significantly longer time exploring the exhibit than the *5-7 group*, $t(57) = 3.28$, $p < 0.05$; in addition, they also spent a significantly longer time exploring the exhibit than the *3-4 group*, $t(55) = 2.39$, $p < 0.05$. However, there was no significant difference between the time spent in exploration between the *5-7 group* and *3-4 group*, $t(58) = .81$, $p > 0.05$. Lastly, no significant interaction was found between the children's age and the presence of their caregivers, $F(2,82) = 1.540$, $p > 0.05$.

These findings reinforced the results of Study 1 by demonstrating once again the presence of caregivers does affect have a positive correlation with the length of time children spent in exploring the museum exhibit. In addition, they demonstrated that children's exploration time with regard to the presence of their caregivers was not affected by age; no matter how old the child is, he or she tended to spend a longer time exploring the exhibit in the presence of his or her caregivers. However, age did affect the length of time that children spent in exploration, such that older children tended to explore for a longer period of time than younger children, regardless of the presence of their caregivers. This contradicts the conclusions of Henderson et al. (1982) that preschool-aged children tended to spend more time exploring than school-aged children. It is possible that attention span does increase with age as Ruff and Lawson (1990) predicted; however, we cannot be sure of this claim as we did not specifically measure attention or learning.

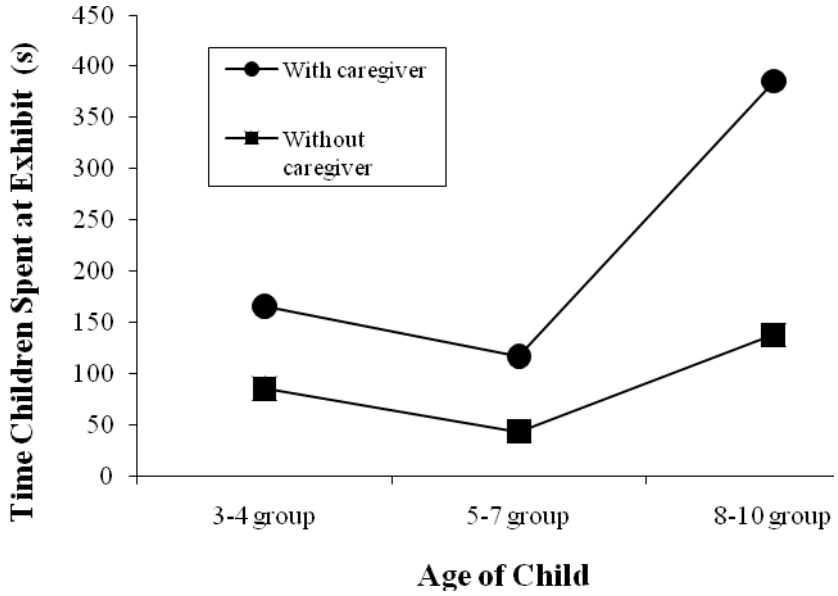


Figure 3. Average time children spent at the exhibit according to age and presence of caregiver.

Discussion

Our results corroborated with previous studies on parental interactions by demonstrating parental involvement indeed exerted an effect on children's behaviors (Crowley et al, 2000) Furthermore, this effect was not significantly related to the age of the children, implying it was the presence of caregivers that directly facilitated children's exploration. We did confirm that the older children explored for a longer period of time than the younger children, which might be due to an increase in attention span during their course of development. According to Ruff & Lawson (1990), increasing attention with age is associated with increasing cognition and complex thought; this explanation may further support the findings that the length of time children spent in exploration is positively correlated with their academic success (Melber, 2003; Sandifer, 1997; Zellman & Waterman, 1998). By taking their children to a museum and actively guiding and/or supporting them, parents could develop their interests and motivations and increase learning opportunities for them (Marjoribanks, 2005), thereby benefiting them intellectually.

We also proposed that children have spent more time exploring the exhibit because they were in the presence of their caregivers. Given the previous research, we argue that this lengthier time increased the probability of children retaining more knowledge from the exhibit they explored. We suspect that the caregivers in the proximity zone to their children were better able to provide guidance that fostered learning in a way different from distant or absent caregivers. Even if the caregivers only provided minimal guidance to their children when they were in close proximity, we suggest this very proximity provided a support that encouraged their children's exploratory activities (and might have enhanced their learning processes). However, as our study

did not examine specific parent-child interactions (e.g. physical help or instructions), we cannot be sure if their interactions or lack thereof had a significant effect on the length of time children would spend in exploration. Caregivers may not necessarily have to play an active role to facilitate learning; their simply being there may facilitate children's exploratory behavior too. This is an important idea for further research as it could encourage caregivers to participate in children's learning simply by allotting time to be with the latter.

We used time as an indicator of the extent of the children's explorations, but this can only provide us with a general impression of learning having possibly taken place. We do not know how and what the children learned from the exhibit, or in what way the caregivers had contributed to their learning. Also, we cannot be sure whether the caregivers were parents, relatives, teachers, chaperones, or some other kind of caretaker. Future research is needed to determine what type of knowledge is gained through exploration, as well as whether the presence of different types of caregivers would interact with learning. Furthermore, age had only been estimated by the researchers and never confirmed by any subject; it would be more ideal if future studies could measure it accurately. In consideration of these factors, we would suggest future studies to conduct structured interviews with the children and their caregivers, as well as assign pre- and post- learning tests to the children, to make up for the shortcoming in using time as a learning indicator. We expect that a more comprehensive approach made up of quantitative measurement, objective tests and qualitative interviews will provide a clearer picture of the extent of the children's knowledge retention.

The relationship between a child and his/her caregiver (usually a parent) is one that can lead to excellence in a child's life. Clearly the dynamics between parents and children is important for healthy childhood development and academic success. Our study determined that children with caregivers tended to be keener to explore than those without. These results could help to facilitate understanding of how parent-child interactions would increase interests and promote learning in children. Our data demonstrated that caregivers who are present and active are likely to influence their children's exploration and education, across all ages and domains of their children's lives. Researchers, educators, and government officials can develop on this data to generate clear theories or advice on parental involvement, by analyzing how the duration and proximity of parent-child interactions may affect children's academic performance.

References

Christenson, S. L., Rounds, T., Gorney, D. (1992). Family factors and student achievement: An avenue to increase students' success. *School Psychology Quartely, 7*(3), 178-206.

Connell, C. M. & Prinz, R. J. (2002). The impact of childcare and parent-child interactions on school readiness and social skills development for low income African American children. *Journal of School Psychology, 40*(2), 177-193.

Crowley, K., Callanan, M. A., Jipson, J. L., Galco, J., Topping, K., & Shrager, J. (2001). Shared scientific thinking in everyday parent-child activity. *Science Education, 85,* 712-732.

Epstein, J. L. (1986). Parents' reactions to teacher practices of parent involvement. *The Elementary School Journal, 86*(3), 277-294.

Fan, X., & Chen, M. (2001). Parental involvement and students' academic achievement: A meta-analysis. *Educational Psychology, 13*(1), 1-22.

Hagen, J. W. & Hale, G. H. (1972). The development of attention in children. In A. Pick (Ed.), *Minnesota Symposia on Child Psychology* (pp. 117-140). Oxford, England: U. Minnesota Press.

Hall, J. A. & Veccia, E. M. (1990). More "touching" observations: New insights on men, women, and interpersonal touch. *Journal of Personality and Social Psychology, 59*(6), 1155-1162.

Henderson, B. B. (1984). Parents and exploration: The effect of context on individual differences in exploratory behavior. *Child Development, 55*(4), 1237-1245.

Henderson, B. B., Charlesworth, W. M., and Gamradt, J. (1982). Children's exploratory behavior in a novel field setting. *Ethology and Sociology, 3,* 93-99.

Kainz, K. & Aikens, N. L. (2007). Governing the family through education: A genealogy on the home/school relation. *Equity and Excellence in Education, 40,* 310-310.

Marjoribanks, K. (2005). Family environments and children's outcomes. *Educational Psychology, 25*(6), 647-657.

Melber, L. M. (2003). Partnership in science learning: Museum outreach and elementary gifted education. *Gifted Child Quarterly, 47*(4), 251-258.

Ruff, H. A., Lawson, K. R., (1990). Development of sustained, focused attention in young children during free play. *Developmental Psychology, 26*(1), 85-93.

Sandifer, C. (1997). Time-based behaviors at an interactive science museum: Exploring the differences between weekday/weekend and family/non-family visitors. *Science Education, 81,* 689-701.

Schofield-Bodt, C. (1987). A history of children's museums in the United States. *Children's Environments Quarterly, 4*(1), 4-6.

Spears, L. E. (2000). *Getting connected: Finding common ground between parents and teachers on issues of parent involvement* (Doctoral dissertation). Retrieved from Dissertation Abstracts International Section A: Humanities and Social Sciences, 61(6-A), 2192.

U.S. Department of Education. (2004). *Parental Involvement: Title I, Part A.* Retrieved from http://www.ed.gov/ programs/titleiparta/parentinvguide.doc

Zellman, G. L., & Waterman, J. M. (1998). Understanding the impact of parent school involvement in children's educational outcomes. *The Journal of Educational Research, 91*(6), 370-380.

ACADEMIC SELF-CONCEPT PRIMING AFFECTS PERFORMANCE

Nicole M. Cranley,
Richard Metzger, and David Ross
University of Tennessee, Chattanooga

Abstract

Students asked to report personal data before taking a test have been shown to perform differently than those who do not. African American students who report their race prior to testing perform worse than those who do not. The effect is also present in participants who report their gender prior to testing. Women who report their gender perform worse than men on mathematics testing, whereas men who report their gender do worse than women on English testing. Our study was designed to find if this effect could apply in a more general setting. We hypothesized that self-concept would influence test performance when participants were asked to report their feelings about their GPA prior to testing. We predicted that a Prior Disclosure group would perform differently than a Post Disclosure group. Students in the Prior Disclosure group with a High GPA Feeling would perform better than those students with a Low GPA Feeling. Fifty-three undergraduate volunteers from the University of Tennessee at Chattanooga were randomly assigned to either the Prior or Post Disclosure condition. They completed a packet that contained a survey that was designed to elicit feelings about their GPA, and an aptitude test with items taken from a practice ACT booklet. We found that our hypothesis proved to be correct. Those participants in the Prior Disclosure group who had a High GPA feeling performed better than those who had a Low GPA Feeling.

Introduction

Self-concept is most simply described as the answer to the question “Who am I?” (Myers, 2005). It is the description of one’s attributes, or self-schemas (Bong & Clark, 1999 in Choi, 2005). Self-schemas would be the characteristics and attributes an individual would choose to describe themselves with. An individual’s attitudes and beliefs can then be shaped by outside influences such as stereotypes and other negative stigmas (Bong & Clark, 1999 in Choi, 2005). The relationship between an individual’s academic self-concept and the effect that has on their performance is the topic of this study.

The inspiration behind this research topic was developed from the procedures that precede an academic test such as the ACT or SAT which often include a survey containing questions about the student's academic efficacy. If a student has a negative perception of their academic efficacy, it could potentially have the ability to negatively affect their test-taking ability. This inability can be related to the concept of stereotype threat developed by Steele and Aronson (1995). Stereotype threat is the idea that individuals experience anxiety due to their membership in a stereotyped group, therefore confirming the stereotype. Studies have shown that if participants report their gender or race prior to academic testing it can positively or negatively affect their performance. Their performance was directly related to the stereotype that was associated within their testing situation. Steele and Aronson (1995) have argued that if African American participants report their race prior to a test that is expressed as a measure of ability they are more likely to perform worse than if they had not reported their race. Stereotype threat has been shown to affect not only race but gender as well. If a student's academic self-concept has the ability to affect their performance on an academic test it could lead to changes in the testing methods used in schools.

Stereotype threat is the fear that one's behavior will confirm an existing stereotype of a group with which one identifies (Seibt, Beate, Forster & Jens, 2004). This can affect anyone who feels an attachment to a group. This fear may lead to an impairment of performance (Steele & Aronson, 1995) Stereotype threat comes from priming of both racial and gender groups. It exists for a number of groups and can have a widespread effect (Stricker & Ward, 2004). Those individuals who are stereotype threat targets not only suffer from feelings of anxiety of confirming the existing stereotype, but also that others will view them in a stereotypical manner (Steele & Aronson, 1995; Marx & Stapel, 2006; Nelson, 2006).

There have been many studies examining stereotype threat which have shown that stereotype threat exists, depending on when the participant is being tested. Marx and Stapel (2006) performed a study which found that participants that were stereotyped targets show feelings of anxiety before they are tested whereas after testing they exhibited feelings of frustration. Non-stereotyped targets exhibited neither of these feelings. Their study suggests that anxiety related to stereotype threat is short-lived, only to be replaced by feelings of frustration after having underperformed on a test. This only applies to those participants in the stereotype targeted groups (Marx & Stapel, 2006). The results provided by Marx and Stapel can be related to this study's argument that feelings of anxiety exist prior to testing. Not only can there be negative affects on the test-taker prior to testing, but also post testing. It could be argued that the feelings of frustration that are exhibited in Marx and Stapel's research could have the ability to reinforce the existing stereotype.

The negative affects of stereotype threat have been examined in different racial groups. Students who report their race prior to taking an exam perform differently than those who report after the exam. In one study, Steele and Aronson (1995) asked college students to report their race prior to taking a test. The participants were split into two groups. One group was told that their test taking ability was being measured, and the other group was told that it was not being measured. There were both equal numbers of Caucasian and African American students in each group. The Caucasian students performed equally in each group, whereas the African American students performed worse if they were in the group that was told their test taking ability was being measured. Stereotypes such as African Americans testing more poorly than other races can hinder the achievement of an individual of that race. Other stereotypes on the basis of race such

as Asian-Americans excelling in the area of academics can also be detrimental even though it may seem like a positive stereotype (Steele & Aronson, 1995).

Stereotypes can also exist for the male and female gender groups. In academia, the stereotype has existed that males excel in the areas of Mathematics, whereas females excel in the areas of English. Spencer, Steele, and Quinn (1999) conducted an experiment that measured participants' math skills. In one condition, the participants were asked to report gender before taking the test. Females in this condition performed worse than males. Whereas, in the other condition where gender was not a demographic, both genders performed equally well (Spencer, et al., 1999).

Self-concept and stereotype threat are present even in young children. A study by Madon, Jussim, and Eccles (1997) was conducted in 12 school districts in Michigan where teachers were asked to evaluate their students and provide each student a self-esteem test followed by a measurement of their concept of math. It was found that teachers who gave students a poor evaluation and students who thought they were going to do poorly actually performed poorly. However, those students who were given positive evaluations and had high self-esteem performed better (Madon et al., 1997). This study can be related to a study performed by Gest, Rulison, Davidson and Welch (2008) that sought to examine the relationship between children's academic reputations amongst their peers and their academic self-concept, effort, and performance. They found that the reputations predicted changes in children's academic self-concept, effort, and performance (Gest et al., 2008). It could be argued that the children's reputations could have been a product of stereotypes resulting in the changes in the children being an effect of a stereotype.

Researchers have argued that stereotypes can affect not only a child's self-esteem, but also how a child's behavior can change in result to a stereotype. In a study conducted by Harris, Milich, Corbitt, Hoover and Brady (1992) with pairs of unacquainted school boys found that the boys who were told that their partner suffered from ADHD, negatively affected the way they treated their partner (Harris, et al., 1992). Not only did the boys treat their partners negatively, but also their partner who was given the label of suffering from ADHD assumed the role and exhibited the characteristics associated with this disorder.

Negative stereotypes can manifest from many different types of characteristics and for a wide variety of individuals, including clients seeking psychological help. These individuals tend to have negative stereotypes automatically attached to them (Sibicky & Dovindio, 1986). A study done by Sibicky and Dovindio (1986) found that a client seeking psychological help was automatically rated poorly by a group of perceivers before the client even came in for interview. Findings from this research show that perceivers automatically create a negative stereotype for their clients. They neglect to provide those clients with the same treatment as everyone else because they see them in a negative stereotypical manner.

In a study by Lundh and Czyzykow-Czarnocka (2001), they found that order can be used as a priming tool. Participants were asked to fill out an abandonment scale prior to participating in a Stoop task (Lundh & Czyzykow-Czarnocka, 2001). The results from their study provide insight into the effects of ordering in relation to methodology used. These results directly contributed to the ordering design of the current study.

In this study the question was raised, does priming a personally relevant feeling affect performance? More specifically, do elicited feelings towards an individual's academic self-concept affect their performance on an academic test? To measure this, the experiment is going to test if an individual stating his/her GPA and feelings towards GPA would affect his/her

performance. The hypothesis for this study is that students will differ in how they perform based on their feelings about their GPA. We have hypothesized that those participants in the experimental condition who receive the GPA Feelings Survey prior to their academic test would score higher or lower depending on their academic self-concept. Those participants who had a positive academic self-concept would score higher, and those with a negative academic self-concept would perform lower. The variables that were examined in this study were whether a participant was given the GPA survey before or after the aptitude test. The dependent variable is the aptitude test score.

Methods

Participants

There were fifty-three participants used in the current study. They were from several different classes at the University of Tennessee at Chattanooga. The classes surveyed were selected by the researchers with the intent of obtaining a wide range of class-rank. This would help to provide a more representative sample. Several of the classes used in this study were approved for testing by the respective instructors and many of the instructors offered extra credit to those students that were willing to participate in the study. The methodology used in this experiment was not harmful to the participants and was not expected to have any negative effects. No identifying demographics were used in order to restrict personal activation with the exception of GPA. Negative self-concept could be elicited by any demographics reported prior to testing.

Instruments

The variables that were examined in this study were academic self-concept that was measured with the survey provided, and academic performance that was measured with the academic test. The independent variable in this study was the participant's academic self-concept and the dependent variable was academic performance.

A packet was distributed to each of the participants. Each packet contained a 15-question survey. Question 1 asked the participants to report their GPA on a 4.0 scale. Questions 2-12 were on a 1 to 5 Likert scale, which were meant to elicit feelings about the participant's GPA. It consisted of questions such as, "Are you proud of your grades?", "Do you feel pressure to make good grades?", and "How do you feel about your current GPA ranking?" Questions 13-15 were on a 1 to 3 Likert scale, which were not used in determining the participant's feeling score. The second part of the packet was a 14-question aptitude test, which was intended to measure basic overall knowledge in the areas of English and Math. The English section contained 8 questions, and the Math section contained 6 questions. The items were taken from the 2005-2006 version of a practice ACT book.

Procedure

A packet was distributed to each of the participants. Each packet contained a fifteen-question survey, and a fourteen-question aptitude test. There were two versions of the packet: one that contained the survey prior to the aptitude test, and the other in the reverse order. The questions in the survey included a numerical report of their GPA (GPA), and several other questions that were designed to elicit feelings about their academic self-concept and efficacy. The questions in the aptitude test were intended to measure a basic knowledge in the areas of English and Math, which were included in the aptitude test because of previous research that

shows stereotype threat can occur for females in Math testing and for males in English testing. The aptitude test items were taken from a practice ACT book. At the end of both versions of the testing packets the participants were asked to report basic demographic information, none of which reveal any type of personal information.

Results

The hypothesis tested in this study were that those participants with a negative academic self-concept (those with a low GPA Feeling score) would score lower on the aptitude test, whereas the participants with a positive academic self-concept (those with a high GPA Feeling score) would score higher on the aptitude test. Both these hypotheses were confirmed in the results of this study.

The analysis approach to this study was designed to test if stating GPA and feelings towards GPA would affect performance. Students were assigned to the High and Low GPA Feeling groups based on a median split of the GPA Feeling Survey scores. If a participant had a GPA feelings score of 37 and below they were considered to have a low GPA feelings score. If a participant had a GPA feelings score of 38 and above they were considered to have a high GPA feelings score. The aptitude test was scored from 0 to 14. The range of scores was 3 to 13. A reliability analysis was run on the GPA Feelings Survey, $r = .75$. The means, standard deviations, and number of participants for the High GPA Feeling group and the Low GPA Feeling group by Prior and Post groups are shown in *Table 1*.

The hypotheses for this study were that students would differ in how they perform based on their feelings about their GPA (GPA). Students with a High GPA Feeling (positive feeling) will perform better than students with a Low GPA Feeling. To test these hypotheses, a 2 x 2 ANOVA was conducted, (GPA order) x (GPA feeling). The results showed that there was a main effect for Feeling Group, High > Low, ($F(1,49) = 4.10$, $p = .048$) and significant condition by GPA High and GPA Low interaction ($F = 7.37$, $p < .009$) as shown in *Figure 1*.

Table 1

Means and Standard Deviations for the aptitude test scores (n = 53)

GPA Feeling	Condition	n	M	*SD*
High	Prior	10	10.70	1.82
	Post	12	8.58	2.27
Low	Prior	17	7.35	3.14
	Post	14	9.07	2.26

Note. GPA Feeling, High and Low is participants score on the GPA Feelings survey; Condition, Prior and Post is based off whether the participant received the GPA Feelings survey before or after the aptitude test; n represents the number of participants per condition; M represents the mean score for each condition on the aptitude test.

The number of participants for both the High GPA Feeling group and Low GPA Feeling group were relatively equal. In the High GPA Feeling group, those participants who were in the Prior Condition (those who received the Feelings Survey before the aptitude test) scored significantly higher than those participants in the Post Condition (those who received the Feelings Survey after the aptitude test). In the Low GPA Feeling group, those participants who were in the Prior Condition scored significantly lower than those participants in the Post Condition. These results showed that the experimental groups (those who received the GPA Feelings Survey prior to the aptitude test) had both the highest and lowest scores on the aptitude test. Those participants in the Prior condition in the experimental group who had a positive academic self-concept scored an average of 10.7 on the aptitude test. Whereas, those participants in the Prior condition in the experimental group who had a negative academic self-concept scored an average of 7.4.

This study had very few outliers. However, these few outliers provided some interesting insight for possible future studies. There were three participants who had had what would be considered a high GPA (3.5-4.0 on a 4.0 scale) but who felt negatively towards it. They also scored lower on the academic test. Even those participants had a high GPA, to them it was not "good enough" or they "still felt pressure to perform better". These participants also reported that they felt pressure from their parents to perform well in school.

Figure 1
Aptitude Score as a Function of GPA Feelings and Exposure Condition

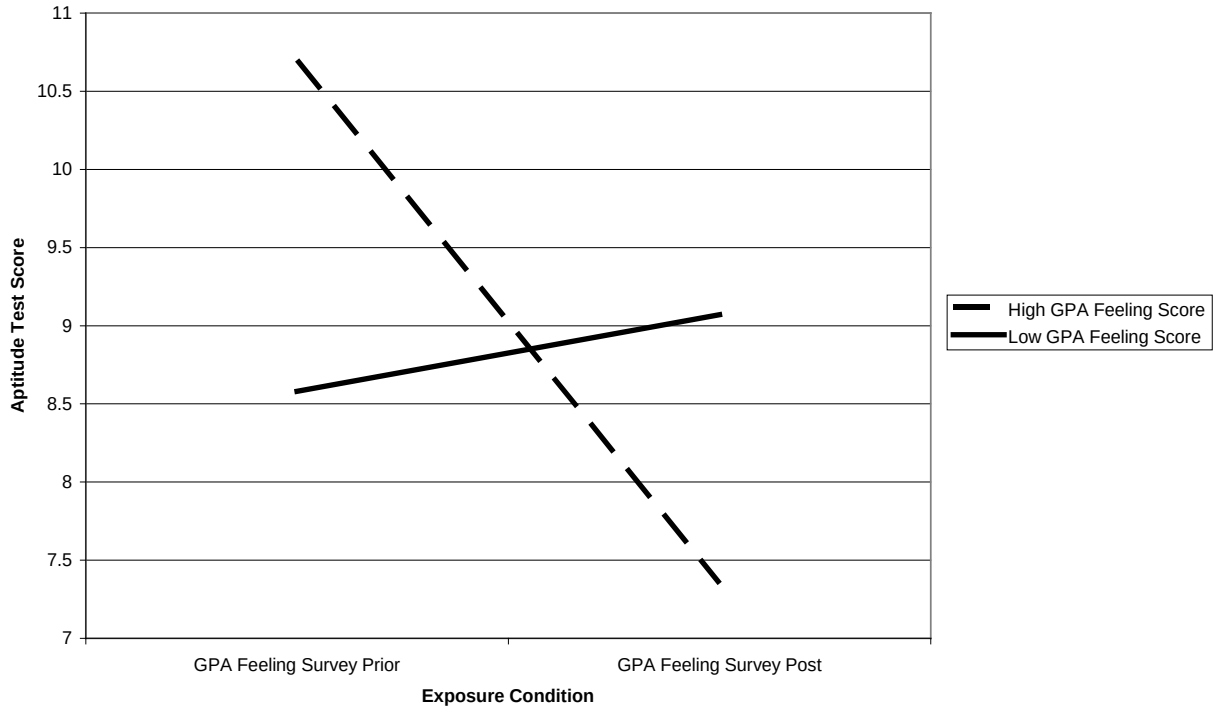


Figure 1. This figure represents the average test scores for both the Prior and Post aptitude test scores in the High and Low GPA Feeling score groups. The mean test score for Low GPA Feeling in the prior group starts at 7.35. The mean test score for High GPA Feeling in the post group starts at 10.70. Where the lines cross in the figure represents the average score of all the participants despite their designated group.

Discussion

The purpose of this study was to find out if priming a personally relevant feeling would affect performance. Our study was designed to see if a participant stating their GPA and feelings towards their GPA before taking an aptitude test would affect their performance. This was investigated by creating a way to elicit feelings about the participant's GPA prior to taking an aptitude test. Our hypothesis was that students with a High GPA Feeling (positive feeling) would perform better than those students with a Low GPA Feeling (negative feeling). As stated in the results section, those participants in the GPA Feeling Survey Prior group who had a Low GPA Feeling score scored significantly lower on the aptitude test. Whereas, those participants in the GPA Feeling Survey Prior group who had a High GPA Feeling score scored significantly higher. These results supported our claim that making students think about their personal performance or self-concept in terms of aptitude and GPA affects students' performance.

Stereotype threat plays a role in performance and it can have a negative effect on performance if activated. Marx and Stapel (2006) showed that depending on when participants were tested is whether or not they will be affected by being in a stereotype threat target group. Our study examined this idea; however, we believe that self-concept plays a heavier role in performance than stereotype threat. If an individual has a negative self-concept, their performance will be affected no matter their race and gender. Thinking about oneself, not merely stereotype threat, can activate the self-schema.

Some limitations were evident in the construct of our study. No demographics were collected in our study in an attempt to eliminate personal activation on the basis of race and gender. However, it had not been considered to put all demographic information at the end of both forms of the packets so that there was no basis for a stereotype threat. In doing this, we would have been able to still collect age, race, and gender demographics without any activation.

Another limitation was present in the aptitude test. The testing items were taken from a practice ACT manual that is considered to be a standardized test. All of our participants have taken standardized tests due to the fact that the ACT or SAT is required for admission to the University. A self-threatening test situation, like a standardized test, can depress or intimidate the test taker. As a result, our participants might have had feelings of depression or anxiety while taking the test that weren't a result of the GPA Feeling Survey.

Every class was given extra credit for participating in our study. However, despite this incentive, some participants may not have taken the academic test seriously. The information used in the academic test was general information from the areas of English and Mathematics, which should have been concepts learned during the participant's years in high school. It could be argued though that the older participants may not be as versed in those areas because they are so far from their high school years. Conversely, the freshmen that were tested may have scored higher because their exposure to these areas was more recent. Therefore, it would have been beneficial to acquire age demographics because age could have been a possible determining factor on a participant's test score.

Since this subject has been scarcely researched there are many avenues for future research. A qualitative portion of the GPA Feelings Survey could have provided even more insight into the effects of academic self-concept priming. For example, one participant reported having a 3.5 GPA, but then rated in the Low GPA Feelings group. This type of outlier could have been further explained if there had been an open-ended question portion of the survey.

The outliers in our study could also provide some information that would be useful in future research on this topic. We found that those participants who had what would be considered a "high" GPA, but felt negatively towards it, scored lower on the academic test. All of these participants also indicated that they felt pressure from their parents to perform well. It would be interesting to investigate if, how, and to what extent this parental "pressure" really affects a student's academic self-concept in relation to how they would score on the academic test.

The results from this study could become very influential in academia. It could possibly affect the administration process of tests in all kinds of educational environments. It implies that other variables can affect a student's test score that could be outside of a student's control. Those students who suffer from low self-esteem about their GPA should be given the same opportunities as other students. With more research social psychologists can provide possible explanations for the existence of a negative academic self-concept.

References

Choi, N. (2005). Self-efficacy and self-concept as predictors of college students' academic performance. *Psychology in the Schools, 42*(2), 197-205.

Harris, M., Milich, R., Corbitt, E., Hoover, D., & Brady, M. (1992). Self-fulfilling effects of stigmatizing information on children's social interactions. *Journal of Personality and Social Psychology, 63*(1), 41-50.

Lundh, L. & Czyzykow-Czarnocka, S. (2001). Priming of the emotional stroop effect by a schema questionnaire. An experimental study of test order. *Cognitive Therapy and Research, 25*(3), 281-289.

Madon, S., Jussim, L., & Eccles, J. (1997). In search of the powerful self-fulfilling prophecy. *Journal of Personality and Social Psychology, 72*(4), 791-809.

Marx, D. & Stapel, D. (2006). It's all in the timing: Measuring emotional reactions to stereotype threat before and after taking a test. *European Journal of Social Psychology, 36*, 687-698.

Nelson, T.D. (2006). Experiencing Prejudice. In The Psychology of Prejudice (2nd ed.)pp. 134-162, New Jersey: Pearson Education.

Seibt, Beate, Forster & Jens (2004). Stereotype threat and performance: How self stereotypes influence processing by inducing regulatory foci. *Journal of Personality and Social Psychology, 8*(1), 38-56.

Sibicky, M. & Dovidio, J. (1986). Stigma of psychological therapy: Stereotypes, interpersonal reaction, and the self-fulfilling prophecy. *Journal of Counseling Psychology, 33*(2), 148-154.

Spencer, S. Steele, C. & Quinn, D. (1999). Stereotype threat and women's math performance. *Journal of Experimental Social Psychology, 35*, 4-28.

Steele, C. & Aronson, J. (1995). Stereotype threat and the intellectual test performance of African Americans. *Journal of Personality and Social Psychology, 69*(5), 797-811.

Stricker, L. & Ward, W. (2004). Stereotype threat, inquiring about test taker's ethnicity and gender, and standardized test performance. *Journal of Applied Social Psychology, 34*(4), 655-693.

THE ROLE OF PARENTAL INTRUSIVENESS IN TREATMENT FOR ANXIETY IN CHILDREN WITH AUTISM

Loran P. Hayes
University of California, Los Angeles

Abstract

Wood (2006) found that parental intrusiveness (PI) is related to levels of separation anxiety in typically developing (TD) children. These links have yet to be examined in a population of children with an autism spectrum disorder (ASD). While it is a well-known fact that diagnoses of ASD are increasing, people are seldom aware that 72% of people with ASD meet criteria for at least one other comorbid psychiatric disorder (Leyfer, et al., 2006). Anxiety disorders are among the most prevalent (35%) of these comorbid disorders (Sze & Wood, 2007). The present study examines PI as related to severity levels of anxiety disorders in a high functioning autism population over the course of modified cognitive behavioral therapy (CBT) for anxiety disorders. Results indicate a predictive relationship between PI and separation anxiety disorder, as well as generalized anxiety disorder. Possible reasons for these associations as well as implications and future research are discussed.

Key abbreviations: PI = parental intrusiveness, ASD = autism spectrum disorder, CBT = cognitive behavioral therapy

Introduction

Wood (2006) defines parental intrusiveness as "when parents take over tasks that children could be or are currently doing independently, thereby restricting autonomy". In the same study, he shows parental intrusiveness to be related to anxiety levels in children with separation anxiety disorder, a common childhood anxiety disorder. While this is important for all groups of children, there are certain special populations in which anxiety disorders are more prevalent than the general population.

It is a well-known fact that autism diagnoses have been increasing at a high rate. Media often report that one in 150 children will be diagnosed with autism. What is much less known, however, is the prevalence of comorbid psychiatric disorders in these children who are diagnosed

with autism. Estimates as high as 72% prevalence have been reported for DSM-IV (APA, 2000) Axis I disorders in children with autism (Leyfer, et al., 2006). Prevalent among these comorbid disorders are anxiety disorders, conservatively estimated at 35% in the autism spectrum disorder (ASD) population (Sze & Wood, 2007). It is also important to note that prevalence of anxiety does not differ between diagnoses of autism and Asperger Syndrome (Kim, et al., 2000).

Naturally, the question of what causes this increase in prevalence of anxiety in the ASD population arises. There are several hypotheses, yet no confirmed causal pathways. Wood (2006) presents a theoretical model whereby children of intrusive parents upon separation experience increased anxiety and distress when presented with a situation or task normally performed by the parent. This increased distress prevents the child from learning how to solve the situation and promotes increased dependence on the parent, beginning the proverbial "vicious cycle". While this is observed in a typical population, there is no literature confirming a link in the ASD population.

Treatment

While the main treatment for anxiety in the typically developing population is Cognitive-Behavioral Therapy (CBT), sometimes in conjunction with psychotropic medications, many hold reservations as to whether such treatment could be effective in children with ASD. In theory, these reservations are well founded. From a theoretical standpoint there are several obstacles to CBT in children with autism. The major barrier to CBT for this population is limited language abilities making it difficult to obtain information from the client, and overall limiting the level of informative communication between therapist and client. A second obstacle to treatment is difficulty with meta-cognition (an essential skill necessary for traditional CBT) as most children with an ASD have difficulty understanding the concept of their own thoughts. Yet another issue facing treatment of anxiety with CBT in this population is that children with autism often lack theory of mind and thus will make seemingly illogical or senseless comments or responses during treatment sessions. While these concerns are valid and have presented some difficulty in CBT for children on the autism spectrum, therapy in children with high functioning autism and Asperger Syndrome as well as pervasive developmental disorder—not otherwise specified (PDD-NOS), has nonetheless been shown to be possible and effective (Sofronoff, Attwood & Hinton, 2005; Sze & Wood, 2007). These studies illustrate the importance and efficacy of multimodal CBT for children with an ASD. Components of effective treatment include teaching coping strategies, emphasize practice or "homework", and employ a parental component in treatment.

Because studies point to the importance of parental involvement as a "co-therapist", it is important for parents to be able to deliver in this capacity. Sharpley, Bitsika, and Efrmedis (1997) indicate above average levels of stress and anxiety among parents of children with autism. It is possible that increased stress and anxiety in parents regarding their children may manifest as greater PI. Research in the area of psychiatric comorbidity with autism is young. Parental involvement in treatment is key to reducing both parent and child anxiety. Certain parenting behaviors and the context in which they occur have been linked to child anxiety (Wood, et al., 2003). This evidence has been shown in a typical clinical sample yet there is still a lack of literature on the topic, and no literature relating intrusiveness to children with Autism and comorbid anxiety disorders. Given this literature, it is reasonable that PI should receive some focus during combined parent-child CBT.

Hypothesis

We hypothesize that a change in total score of child report measures of parental intrusiveness will predict a change in separation anxiety disorder severity ratings across time points in CBT for anxiety in children with Autism, similar to Wood (2006). To this point, there is no evidence to suggest that severity ratings for other anxiety disorders will be predicted by PI.

Methods

Participants

Participants included 44 children (33 males and 11 females) between seven and 13 years of age diagnosed with an ASD. Twenty-four of the participants had a diagnosis of Autistic disorder, 14 with PDD-NOS and 4 with Asperger Syndrome [Table 1]. The gender disparity in this sample is expected—ASD diagnosis is much more common in males than females. Participants were "high functioning" as defined by a score of 70 or higher on the *Vineland Adaptive Behavior Scale* (VABS; Sparrow, Balla, & Cicchetti, 1984). Additionally, participants met diagnostic criteria as per the *Diagnostic and Statistical Manual of Mental Disorders-IV* (*DSM-IV*; American Psychiatric Association, 2000) for at least one of the following anxiety disorders; Generalized Anxiety Disorder (300.02; APA, 2000), Separation Anxiety Disorder (309.2; APA, 2000), or Social Phobia (300.23; APA, 2000). Ten participants met criteria for Generalized Anxiety Disorder, 18 for social phobia and 16 met criteria for separation anxiety disorder as primary anxiety diagnosis. However, totals for anxiety diagnosis were much higher; 40 children met diagnostic criteria for each anxiety disorder [Table 1]. The presence of an additional anxiety disorder diagnosis (e.g. OCD) did not warrant exclusion of a participant. Each child had at least one primary parent participate in the study, both in treatment sessions as well as assessments. Participants were recruited via referrals from community mental health agencies, as well as flyers placed within these agencies. Children were compensated five dollars for completion of each assessment battery, and the treatment intervention was provided at no cost to the families.

Procedure

Graduate students conducted initial phone screening interviews with a parent of a potential child participant. The screening was informal and addressed age, ASD diagnosis, IQ, and anxiety symptoms. If the graduate student determined that the child would possibly meet inclusion criteria for the current study, the child and primary parent were scheduled for an intake assessment. Participants were randomized into one of two groups, either immediate treatment or wait-list control conditions. The immediate
treatment group began treatment following a baseline assessment, provided the participant met inclusion criteria for the study. The wait-list control group began treatment after a three-month delay following the baseline assessment. During the three-month delay, wait-list control participants were allowed to continue with any forms of treatment in which they were currently engaged. The treatment phase of the study lasted up to 16 weeks of intervention once per week (see Treatment section below).

Table 1: Demographics and Diagnoses

Sex	*Frequency*
Male children	33
Female children	11
Male primary guardian	9
Female primary guardian	35
Ethnicity	
White	23
African-American	1
Asian	7
Latino/Hispanic	5
Other/mixed	11
Primary Anxiety Diagnosis	
Generalized Anxiety Disorder	10
Social Phobia	18
Separation Anxiety Disorder	16
Other	3
Total Anxiety Diagnosis	
Generalized Anxiety Disorder	40
Social Phobia	40
Separation Anxiety Disorder	40

Participants were asked to refrain from engaging in any additional services following their initial assessment in order to control for added effects of other treatments in addition to the current intervention. Participants were administered questionnaires and assessments during a baseline assessment (Time 1) before the commencement of treatment, and at the end of treatment (Time 2). The wait-list group had an additional assessment following their three-month waiting period and prior to the start of the intervention (Time 1a). The current treatment was an adapted version of the *Building Confidence* (Wood, Drahota, and Sze, 2008) modularized treatment manual originally developed for typically developing children with anxiety. In the current study, this manualized treatment was modified by Dr. Jeffrey J. Wood for use with children with ASD and comorbid anxiety disorders. All activities pertaining to the study were conducted at the University of California, Los Angeles (UCLA) at either the Neuropsychiatric Institute (NPI) or the Department of Education.

Measures

Anxiety Disorders Interview Schedule for Children-IV (ADIS-IV; Brown, DiNardo, & Barlow, 1994). Anxiety was assessed using the ADIS in both child report (ADIS-C) and parent report (ADIS-P) forms. Both versions of the ADIS have been shown to reliably diagnose anxiety disorders (Silverman & Albano, 1996). The ADIS-C and ADIS-P were used to determine whether participants met anxiety inclusion criteria for the present study. Child and parent forms were used by the diagnostician to make the anxiety diagnoses. Severity was assessed on zero to eight scale, with zero meaning no severity for a particular disorder, and eight meaning extremely severe/impairing.

Vineland Adaptive Behavior Scale (VABS; Sparrow, S.S., et al.1984). The VABS is a measure used to assess functioning in personal and social areas of life. Four main domains are

addressed in the VABS: communication, daily living skills, socialization, and motor skills. The VABS score can be compared with population percentiles given in the VABS manual.

Autism diagnostic criteria were assessed using two measures, the *Autism Diagnostic Interview—Revised* (ADI-R; Lord, et al., 1994), and the *Autism Diagnostic Observation Schedule* (ADOS; Lord, et al. 1999). The ADI-R is a 93-item standardized interview administered to parents. The ADOS is a semi-structured performance based protocol for observing social and communicative behavior of children. The ADI-R and ADOS were used to determine whether participants met inclusion criteria relating to autism for the present study.

The measure of parental intrusiveness used in the present study, *Me and My Mother* (or *Father*), depending on the guardian participating in the study; abbreviated MMP), is a 33-item child report measure (Wood, 2006). Items addressed parent-child interaction regarding the child's daily routine. Answers are based on a three point scale (1 = never, 2 = some days, 3 = every day). Questions included items such as "How often does your mom/dad interrupt you so that s/he can tell you something?" and "How often does you mom/dad stay in your room while you fall asleep?" and address interactions only within the previous two weeks at time of administration. The MMP also has a matching parent report measure, the *Parent-Child Interaction Questionnaire (PCIQ; Wood, 2006).* Both forms of this measure are shown to have both reliability and validity as well as high levels of parent-child agreement (Wood, 2006).

Measures were administered at each assessment point (Times 1, 1a and 2). Both parent and child forms of the ADIS were administered at all time points following Time A but targeted only anxiety disorders for which the participant had previously met criteria during the baseline assessment.

Treatment

Treatment in the present study is comprised of two components; individual cognitive-behavioral therapy (CBT) for children and conjoint individual CBT for the participating guardian with respect to their child. The same therapist delivered the treatment intervention to each child/guardian dyad.

Parental CBT involves helping the parent support the child's participation in the treatment intervention. Early sessions focus on assisting the parent in developing communication skills to help the children, and building parental confidence in this domain. The later sessions seek to focus on implementing, practicing, and troubleshooting these new skills. This includes the primary parent learning to support the child's independence and autonomy, and additionally supporting the child's coping skills developed during the course of treatment.

Therapists were directed under the supervision of clinical psychologist Dr. Jeffrey Wood, Assistant Professor, UCLA Graduate School of Psychological Studies in Education. All therapists held at the least a Master's degree in either clinical psychology or Psychological Studies in Education. Undergraduate research assistants provide supervision to the children during the parental CBT portion of sessions including playing games and structuring other activities, as well as participating during *in vivo* exposures.

All study procedures were approved by the UCLA Institutional Review Board.

Results

Regression analyses

Linear regressions were used to examine the relationship between PI and anxiety. Using a change in the total score of PI (N = 44, M = 3.07, SD = 4.67) from pre-treatment to post-

treatment to predict a change in overall primary anxiety disorder severity (N = 44, M = 1.14, SD = 1.36), a linear regression yielded R = .218, β = .199, p > .15, not significant at the set .05 alpha-level. For this first analysis, there was no differentiation between anxiety disorder diagnoses (concurrent with Wood's [2006] findings); however, the subsequent analyses focus on specific anxiety disorders. When comparing a change in generalized anxiety disorder severity (N = 40, M = 0.93, SD = 1.83) to the change in the total score of PI (N = 40, M = 3.02, SD = 4.67), a linear regression analysis produced R = .614, β = .572, p < .001 [Figure 1]. When comparing a change in separation anxiety disorder severity (N = 40, M = 1.2, SD = 1.95) and a change in PI (N = 40, M = 3.54, SD = 4.24) we found R = .35, β = .34, p < .05 [Figure 2]. Finally, when comparing change in PI (N = 43, M = 2.95, SD = 4.52) and change in social phobia severity ratings (N = 43, M = 1.09, SD = 1.80) the linear regression yielded a non-significant result R = .303, β = .275, p = .076. In conclusion, evidence for the expected link between separation anxiety and PI in the ASD population was found. A summary of regression analyses is detailed in Table 2.

Figure 1
Change in Parental Intrusiveness vs. Change in GAD severity

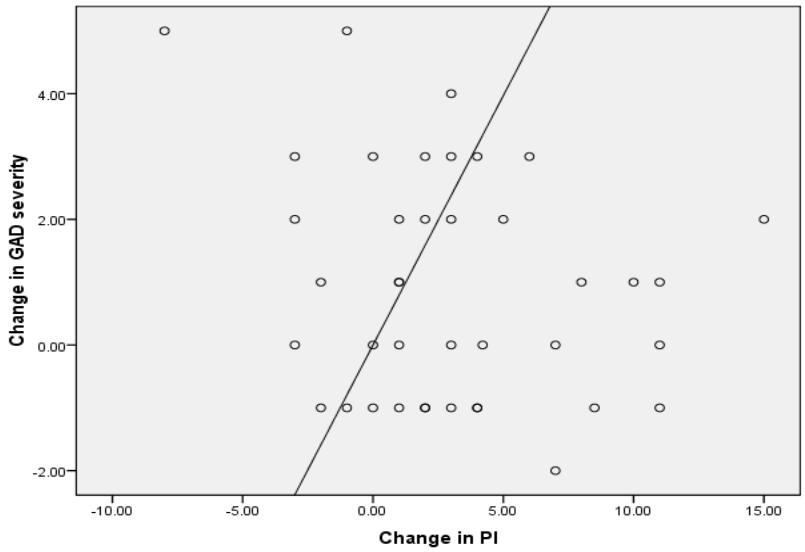
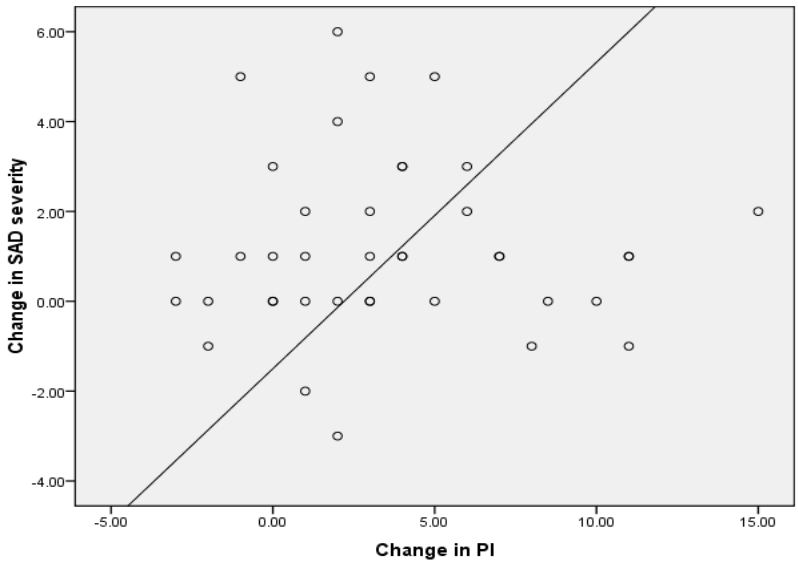


Table 2: Regressions

Diagnosis	$M_{\Delta severity}$	$SD_{\Delta severity}$	$M_{\Delta PI}$	$SD_{\Delta PI}$	R	β	p
Primary anxiety diagnosis	1.14	1.36	3.07	4.67	.218	-.199	.185
Separation anxiety disorder	1.20	1.95	3.54	4.24	.339	.344	.035
Generalized anxiety disorder	0.93	1.83	3.02	4.67	.614	.572	<.001
Social Phobia	1.09	1.80	2.95	4.52	.303	.275	.076

Figure 2
Change in Parental Intrusiveness vs. Change in SAD severity



Discussion

The hypothesis was confirmed by finding a statistically significant predictive relationship between PI and separation anxiety disorder severity. As expected, there is no evidence of a relationship between PI and primary undifferentiated anxiety diagnosis severity. When separating each anxiety diagnosis, however, and comparing PI to the respective diagnosis severity, we saw an unexpected relationship with generalized anxiety disorder.

Separation Anxiety and Parental Intrusiveness

The link between separation anxiety disorder and PI was expected due to Wood's (2006) findings in typically developing children. Both constructs directly relate to the parent (provided that the object of attachment in the separation case is the parent, as it is in the present case), and perhaps a reduction in PI leads to less dependence on the parent, and thus less anxiety upon a separation event. While no causal model exists due to the nature of the analyses, logically one would tend to assume that the direction of effects is of a reduction in PI leading to lower levels of separation anxiety, rather than the reverse, though this set of analyses cannot prove this. Further research into causal models should continue.

Generalized Anxiety Disorder and Parental Intrusiveness

The results establishing a link between generalized anxiety disorder severity and PI were surprising. While we expected to find a link between separation anxiety and PI was expected due to the parent being the common factor between the two, persistent worries in generalized anxiety disorder are focused on any number of things and are not constrained to one factor between individuals. The existing literature on PI does not provide a theoretical framework from which to interpret this result. There are many possible explanations for this association. For one, it is well known that children with an ASD are more dependent on parents (Koegel, et al., 1992) in many facets of daily life. It is possible that with a reduction (or increase) in parental intrusiveness, there is a corresponding change in dependency of the child on the parent, and thus

an increased confidence of functioning in daily life, and thus fewer worries in this domain. The reader may raise the issue that worries commonly associated with generalized anxiety disorder are often distinct from "everyday worries", however, generalized anxiety disorder manifests somewhat differently in children where "everyday worries" are a common focus of generalized anxiety in children (APA, 2000). Diagnostic criteria of generalized anxiety disorder is also more "loose" in children—only one symptom in section C of the diagnostic criteria for generalized anxiety disorder is required of children for diagnosis, whereas a minimum of three symptoms are required for a diagnosis in adults. Thus, possible over-diagnosis is more likely to occur in this population with most children meeting criteria for more than one anxiety disorder. If generalized anxiety disorder was overly diagnosed at Time 1, this could explain the lack of severity at Time 2. Of course, due to the correlational nature of the data, other variables not analyzed in this paper account for variance not explained by PI in complex treatment cases such as these. *In vivo* exposure likely plays a central role, as does cognitive restructuring.

Social Phobia and Parental Intrusiveness

While a statistically significant relationship was not seen when comparing PI and social phobia, the results were marginally significant. There is no theoretical model for these variables, one might assume that a reduction in PI and thus a reduction in separation anxiety may lead to higher levels of child confidence and those increased social functioning. Research and analysis should continue in this area to find other variables that may be contributing to this trend.

Implications for Treatment

Overall, the data provide support for the inclusion of a parental component in the treatment program. When the therapist is able to meet with the parent, especially one-on-one, the therapist can work with the parent to establish helpful, functionally appropriate behaviors toward the child without being intrusive, allowing the child to have greater autonomy where it is warranted. Thus, parent involvement and effort therapy aimed at improving anxiety in this population is important, just as it is important for the children to practice their own coping skills learned in the CBT sessions. To be certain, PI is only one of a plethora of constructs contributing to anxiety severity, yet it is an easily targeted factor in therapy to potentially reduce anxiety levels.

Future Research

Future research should continue in this area. There is a lack of literature in the area of anxiety and ASD and the role parents can play in reducing anxiety. Additionally, further measures of parental intrusiveness should be used. The measure used in the present study is a child-report measure, but a parent report as well as a behavioral observation would add validity to the results much in the same way of Wood (2006). Future studies should also seek to examine other factors that possibly interact with PI to affect the level of anxiety post-treatment.

References

American Psychiatric Association. (2000). Diagnostic and statistical manual of mental disorders, (4th ed., text revision). Washington, DC: American Psychiatric Association.

Ghaziuddin, M., Alessi, N., & Greden, J.F. (1995). Life events and depression in children with pervasive developmental disorders. *Journal of Autism and Developmental Disorders, 25(5)*: 495-502.

Kim, J.A., Szatmari, P., Bryson, S.E., Streiner, D.L., and Wilson, F.J. (2000). The Prevalence of Anxiety and Mood Problems among Children with Autism and Asperger Syndrome. *Autism, 4(2)*: 117-132.

Koegel, R L., Schreibman, L., Loos, L.M., Hanne Dirlich-Wilhelm, H., Dunlap, G., Robbins, F., and Plienis, A. (1992). Consistent stress profiles in mothers of children with autism. Journal of Autism and Developmental Disorders, 22(2), 205-216.

Leyfer, O.T., Folstein, S.E., Bacalman, S., et al. (2006). Comorbid Psychiatric Disorders in Children with Autism: Interview Development and Rates of Disorders. *Journal of Autism and Developmental Disorders, 36(7)*: 849-861.

Lord, C., Rutter, M. L., DiLavore, P. C., & Risi, S. (1999). Autism Diagnostic Observation Schedule—WPS (WPS ed.). Los Angeles: Western Psychological Services.

Lord, C., Rutter, M., & LeCouteur, A. (1994). Autism diagnostic interview-revised: A revised version of a diagnostic interview for caregivers of individuals with possible pervasive developmental disorders. Journal of Autism & Developmental Disorders, *19*: 185–212

Muris, P., Steerneman, P., Merckelbach, H., et al. (1998). Comorbid anxiety symptoms in children with pervasive developmental disorders. *Journal of Anxiety Disorders, 12(4)*: 387-93.

Sharpley, C.F., Bitsika, V., Efremidis, B. (1997). Influence of gender, parental health, and perceived expertise of assistance upon stress, anxiety, and depression among parents of children with autism. *Journal of Intellectual and Developmental Disability. 22(1)*: 19-28.

Silverman, W.K., and Albano, A.M., (1996). Anxiety Disorders Interview Schedule for DSM-IV, Child Version. Oxford University Press. Sofronoff, K, Attwood, T, and Hinton, S. (2005). A randomised controlled trial of a CBT intervention for anxiety in children with Asperger syndrome. *Journal of child psychology and psychiatry and allied disciplines, 46(11)*: 1152-60.

Sparrow, S., Bulla, D. A., Cicchetti, D. V. (1984). The Vineland Adaptive Behavior Scales: Interview Edition, Suney Form. Circle Pines. MN: American Guidance Service.

Sze, K. and Wood, J. J. (2007). Cognitive Behavioral Treatment of Comorbid Anxiety Disorders and Social Difficulties in Children with High-Functioning Autism: A Case Report. *Journal of Contemporary Psychotherapy. 37*: 133-143.

Wood, JJ. (2003). Parenting and childhood anxiety: Theory, empirical findings, and future directions. *Journal of child psychology and psychiatry and allied disciplines, 44(1)*: 134-134.

Wood, JJ. (2006). Parental Intrusiveness and Children's Separation Anxiety in a Clinical Sample. *Child psychiatry and human development, 37(1)*: 73-73.

Wood, J.J., Drahota, A., & Sze, K.M. (2007). Cognitive behavioral therapy for anxiety and social problems in children with autism: Intervention manual. unpublished treatment manual developed at the University of California, Los Angeles.

Wood, J.J., Piacentini, J.J., Southam-Gerow, M., et al. (2006). Family Cognitive Behavioral Therapy for Child Anxiety Disorders. *Journal of the American Academy of Child and Adolescent Psychiatry, 45(3)*: 314-321.

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