Priming Creativity Using Multiple Artistic Objects

by

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ABSTRACT

As the desire for innovation increases, individuals and companies seek reliable ways to encourage their creative side. There are many office superstitions about how creativity works, but few are based on psychological science and even fewer have been tested empirically. One of the most prevalent superstitions is the use of objects to inspire creativity or even make a creative room. It is important to test this kind of notion so workplaces can find reliable ways to be innovative, but also because psychology lacks a breadth of literature on how environmental cues interact with people to shape their mental state. This experiment seeks to examine those gaps and fill in the next steps needed for examining at how multiple objects prime creativity.

Participants completed two creativity tasks: one for idea generation and one that relies on insight problem solving, the Remote Association Task. There were four priming conditions that relied on objects: a zero object condition, a four neutral (office) objects condition, a single artistic object condition, and finally a four artistic objects condition. There were no differences found between groups for either type of task or in mood or artistic experience. The number of years a participant spent in the United States, however, did correlate with mood, idea generation scores, and insight problem scores. This potentially demonstrates that performance on idea generation and insight tasks rely on the tasks created and culture.

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CHAPTER 1

BACKGROUND

As the desire for innovation increases, individuals and companies seek reliable ways to encourage their creative side. There are many office superstitions about how creativity works, but few are based on psychological science and even fewer have been tested empirically. One of the most prevalent superstitions is the use of objects to inspire creativity or even make a creative room. It is important to test this kind of notion so workplaces can find reliable ways to be innovative, but also because psychology lacks a breadth of literature on how environmental cues interact with people to shape their mental state. This experiment seeks to examine those gaps and fill in the next steps needed for examining at how multiple objects prime creativity.

The importance of creativity

Creativity is valuable but poorly understood. The new economy in Western culture is thought to be a "creative economy"—one based on hiring workers to provide creative goods and services (Lee, Florida, & Acs, 2004; United Nations, 2008). Creativity is thought to facilitate the creation of new and profitable products which in turn seem to make the difference in what people purchase (Elliot & Nakata, 2013). Indeed, people commonly evaluate how creative a product is by judging how useful and new it is to the population (Kaufman & Sternberg, 2010), and companies that specialize in product design often cite creative processes as highly important to their success (Kelley & Kelley, 2013).

Among the reasons why creativity is important to success is that consumer choice has become increasingly important in modern economies. In a developed economy, there are many products to meet basic needs which gives consumers the power to choose between alternatives. Consumer choice is not a simple thing. One might assume that value is mainly dependent on cost. However, psychological studies highlight the importance of experience over material rewards to consumers (Van Boven & Gilovich, 2003) and how products are chosen by people to fit their emotional needs (Levav & Zhu, 2009). To meet these psychological desires, product developers have adapted by using their creativity to design products to give people experiences

that fufill these evolving and complex needs, whether that experience is limited or a part of a comprehensive lifestyle.

Consequently, designers are attempting to understand the subtle needs of consumers and accommodate those needs into a company's products. "Design thinking" (Buchanan, 1992) is starting to permeate the entire product development process as other workers are also starting to see that understanding user needs and wants impacts all stages of a project. Creativity is thought of as the mechanism that promotes design thinking, because of its insightful and broad nature. Creativity for modern product design requires that developers expand their thought process from solving a specified problem to understanding and fulfilling a larger, and more global needs of people. With their minds set on answering more than the specific problem as it is originally presented, designers create a different experience using a broader range of features than what is already on the market.

As a result, creativity is seen as a way to solve problems both old and new. Runco (2004a) points out that people see creativity as a way to help cope with the high speed of cultural and technological advances in society. For example, a creative person can create a new invention or simply see a new, more efficient method for getting work done. Consequently, managers are trying to hire prospects that are "creative", and businesses seek quick fixes to boost creativity of workers already employed.

However, creativity is a concept that is both abstract and subjective; a consistent method to make people think about concepts differently can at first seem to be a complete contradiction. Nonetheless, common wisdom has given birth to superstitions based on the loose associations people have with creativity. As creativity is associated with items like art and toys, businesses and people try to add these touches to their office space. Of course, common wisdom is not always far off. People often subconsciously act on what they believe. A simple act such as washing one's hands can be associated with washing away luck and make people behave more conservatively while gambling (Lee & Schwarz, 2011). Similarly, washing one's hands can be a form of washing away sins and make people feel less guilty.

Nonetheless, it is unknown how these cues actually affect people or interact with other items in the office environment. If companies wish to capitalize by using objects that will inspire workers to make a creative good or service that can be used in the competitive economy, they need to know what kinds of things will work. To understand what works, one first must understand how creativity is defined.

What is creativity?

For a business, a creative good or service can be tangible or intangible, but it has to be "work that is novel, high in quality, and appropriate" (Cropley, 2006; Kaufman & Sternberg, 2010; Peppler & Solomou, 2011).

Novelty is how new a concept is and is synonymous with originality. It takes both an understanding of what already exists and a way to break apart components of old ideas to evaluate how different a concept is from its predecessors. There is room for gray areas of course. For example, if a method to do something becomes out-of-date and goes unused for decades, it is hard to judge how novel it is to apply that same method again suddenly but in a new industry.

Quality is the next property. A quality product is detailed in its execution and no vaguer than it needs to be. It is related to mapping out the plan necessary to go from the state of having a problem to the state of not having the problem. If an idea is low in quality, a problem can persist by slipping through the cracks in the design.

Finally, the last characteristic is how appropriate a product is. An appropriate product is one that is is perceived at solving the issues at hand. People should believe the product effectively addresses their issues. It would be more appropriate to give a packet of sugar to someone looking to sweeten their tea than it is to give them a lemon. Consumers also assume that an appropriate solution is one that does not create more urgent issues when the problem is solved. For example, a poisonous sweetener for our tea drinker would be considered an unsuitable solution.

When it comes to creative products, these measures of novelty, quality, and propriety require subjective measures. They often rely on an "it depends" level of context and even the

knowledge of the individual. The charms of a product that solves an issue on a Mac are useless to a Windows user who cannot use the device and vice versa. These two groups expect different behaviors and have different problems. Accordingly, judgments of creativity depend on which population is being assessed as the ratings of novelty, quality, and appropriateness fluctuate between groups and even individuals.

However, creativity does have aspects that are not entirely subjective. A more concrete way to explain how creativity works is that a creative person must create a link in people's minds that is new and useful, but not so far-fetched that it does not make sense and is rejected from the general population (Cropley, 2006). Much like art, it generates a way to consider a topic that a person never thought of before, but can still relate towards.

This model relies on the notion of how "distant" ideas are from each other in the mind. Whereas physically distant pieces of the brain do work together to create novel ideas (Schlegel, Kohler, Fogelson, Alexander, Konuthula, & Ulric Tse, 2013), this model relies on "psychological distance". The representation of concepts as nodes with psychological distance between nodes is an older concept that was eptomized first by multidimensional scaling (Kruskal, 1964; Shepard, 1980), and then later by Pathfinder networks (Schvaneveldt, Dearholt, & Durso, 1988). In these theories, the more related a concept is to another, the shorter the psychological distance between them.

The relatedness of concepts can change. Figure 1 gives a simple example. Perhaps a person does not relate cats to hyenas. However, a creative spark makes them realize that they

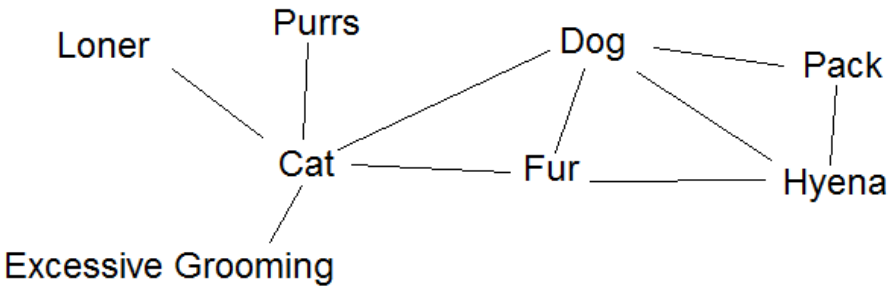

Figure 1. Original Cat-Hyena Model. The original way someone thinks about Cats and Hyenas has a great distinction between the two.

can connect the traits of a cat to a hyena such as purring and excessive grooming. Thus, a new connection is born (Figure 2). Through this creative idea and possibility, this person can use this new connection to make a creative statement in a piece of art. In a similar but not so simple way, someone can see the connection between two usually very separate diseases and find a vaccine for one based on the other's vaccine.

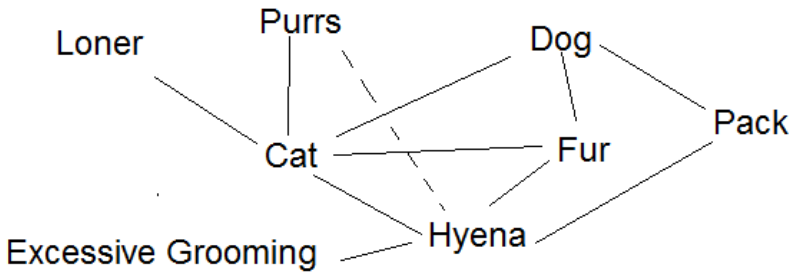

Figure 2. Altered Cat-Hyena Model. Having made some connections, Hyenas move closer to the person's concept of a cat and a new way to think about Hyenas is made.

There is support in the literature about how mental restructuring and widening one's scope aids in problem solving tasks. Dayton, Durso, and Shepard (1990), Onorato (1990), and Durso, Rea, and Dayton (1994) examined the mental structure of participants solving an insight problem between key words such as bartender, hiccups, and water. They asked participants to rate how related (psychologically close) pairs of words within the riddle were. Participants who solved the problem had a different structure of relationships than those who did not. The "solvers" related key pairs of words (such as "remedy" and "relief") closely. As part of their experiment, Durso et al. asked participants to rate the relationships between pairs every 10 minutes. The most interesting group showed a sort of mental restructure close to the time of solving the riddle where unrelated key pairs were considered a lot more related right before they solved the problem in an "aha!" moment.

Restructuring is also associated with solving more insight problems in more indirect ways. Wagner et al (2004) showed a dramatic increase in the number of insight problems participants solved after sleep versus wakefulness. The researchers proposed that the reconsolidation of memory that takes place in the hippocampus during sleep was responsible for

the increase. In Dodds, Smith, and Ward's work (2002), participants who receieved a higher level of instruction to watch for and think about the helpful clues they encountered later were better able to assimilate them into their problem solving than those without instruction. This suggests that putting effort into restructuring concepts can aid problem solving.

How to influence creative levels

If reorganizing the connections between concepts is significant to solving creative problems, then narrow mindsets inhibit creative problem solving. Those with a narrow mindset can get stuck thinking only of concepts already associated with the problem. This phenomenon can be thought of as fixation (Finke, 1996), or anchoring. Fixation is a narrow focus on a problem space and in creativity research, manifests itself as borrowing many old ideas or not being able to solve insight problems.

Whereas fixation can help standard analytical problems that need more focus, it hinders creative problem solving as people cannot generate new ideas or make the necessary restructuring. In fact, functional fixedness came to light to describe why participants could not solve an insight problem (Duncker & Lees, 1945). In the classic experiment, when people are presented with the matchbox as a holder for matches, they fail to realize the other potential functions it can serve, such as the solution where it can be a stand for the candle.

On the other hand, a broad mindset has been shown as useful for solving problems that require insight to solve instead of a formulaic way to think (Durso, Rea, & Dayton, 1994; Metcalfe & Wiebe, 1987). With no surprise, we tend to classify those who are good at details and solving such problems as analytic and those who tend to see the "big picture" as creative.

Still, though people may have tendencies to think in one style or the other, creativity is not a stagnant trait. Runco (2004b) highlights that anyone can be creative when given the right context. Runco, Isen, Daubman, and Nowicki (1987) demonstrated the link between positivity and creativity in a series of studies. When Runco and his colleagues gave participants a small bag of candy or asked them to watch a comedy film, they found that participants in these conditions solved more creative insight problems than those who were given neutral or negative ideas. The

groups had no other difference between them, suggesting that positivity played a larger role than natural ability which would have been randomly distributed among the groups. In one of the latter replications, Estrada, Isen, and Young (1997) showed that this positive affect can help experts overcome the effects of anchoring in problem solving by asking physicians to solve a case study where the key insight is to consider the liver.

Psychologists now point out that the reason positivity probably works so well to induce creative solving is that positivity indeed makes one think in a broader, more global way (Norman, 2003). Norman points out that when people are in good moods, they are more likely to be flexible in what they do to make a product such as an automatic teller machine (ATM) work. He theorizes that is advantageous for humans to be innovative when things are going well and to stick with what has worked before when things are not going as well.

Of course, there are other ways to encourage this broad mindset in people. One can prime people with concepts that make them take on a more global, abstract mindset. Priming involves stimulating a concept in a person's mind, which in turn activates related concepts and affects how a person interprets incoming information. This is called the "spreading activation" or "spreading-excitement" model, in which neurons firing for one concept prime other neurons that are typically excited in conjunction (Collins & Loftus, 1975; Quillian, 1962). For example, in a task in which participants need to decide if a second word is a real word ("doctor") or a random string of letters ("mkeny"), participants responded fastest when the previous word was related to the second word ("nurse-doctor") (Meyer & Schvaneveldt, 1971) . "Bread-doctor" would have a slower response time by comparison.

Priming has been shown to affect attitudes nonconsciously. For example, Higgins, Rholes, and Jones (1977) asked participants to complete a task where they both identified colors and read words. In one condition, the words were related to the idea of recklessness. In another, the words were related to the concept of adventurous. Then, participants completed a seemingly separate task: they read a description of Donald who had all sorts of exciting hobbies such as skydiving and then were asked to give an impression of Donald. Those in the reckless words

condition judged Donald as such and had a negative tone whereas those in the adventurous words condition rated Donald more positively.

Bargh and Chartrand (1999) extended this theory to characterize the effects of priming on behavior. In what is called the perceptual-behavioral link, the environmental cues are sensed by participants and affect their actions. Isen's work with her colleagues is cited as evidence as candy and comedy encourage a positive mood. In another example, Fitzsimons, Chartrand, and Fitzsimons (2008) demonstrated that an Apple logo, which is associated with creativity in design, primed participants to generate more unusual uses of objects in Guilford's Alternative Uses Task (Guilford, 1967) than those primed with IBM.

The Apple brand prime is a direct association between the prime and creativity. Researchers have also shown that indirect associations from a prime to an abstract goal can facilitate creative problem solving. Förster, Epstude, and Ozelsel (2009) ran two studies: one in which people were consciously primed with the idea of a loving relationship or sex and one in which people were subconsciously primed with love or sex in a word search. In both situations, people primed with love thought more globally and solved more insight problems than those primed with neutral or opposite concepts. That is, their cognitive strategy changes such that they think and behave in a broader, more creative view and see the bigger picture.

Jia, Hirt, and Karpen (2009) showed a link between creativity and abstract thought that relies on the person thinking of objects that are not even related to them. Their research is based on construal theory which states that concepts distant from oneself are thought of in more abstract terms than closer concepts. Jia et al. showed that when people had to think of transportation modes that went farther or thought their data would be analyzed by someone farther, people were more creative than when the transportation or researcher were closer.

This distance concept is possibly echoed using time instead of physical distance in a study where students were told to imagine a day off now or a day off if they were 7 years old again (Zabelina & Robinson, 2010). Students who were told that they were 7 years old generated many more original ideas than those who not told they were 7 years again. The authors theorize that students who were primed with childhood were taken back to an unrestricted mindset as

children are thought of as “free” and “uninhibited”. However, there are two more possibilities that explain why the prompt was effective in encouraging abstract thinking: first, being 7 years again is being granted something already impossible and second, a day off while 7 years old is also much more distant in time than a day off in present and this encourages less concrete thoughts. The latter is more aligned with Jia et al., but it is hard to isolate a single factor.

Creativity can also be encouraged when people encounter, and are open to, very different concepts. In one series of studies, Leung and Chiu (2010) demonstrated that being exposed to both American and Chinese cultures lead to more creativity than either culture alone. Although they did not isolate the mechanism, they believe that people in the juxtaposition condition were sampling from both cultures and thus drawing from a broader pool of ideas.

Priming Creativity with Objects

The environment of the perceptual-behavioral mechanism extends to objects in it. Berkowitz and LePage (1967) found that a gun on the table was associated with participants acting more aggressively. Briefcases, a symbol of business, in a room primed students to act more competitively in a monetary-based game (Kay, Wheeler, Bargh, & Ross, 2004). Still, much research remains to be done with objects in the environment and how multiple objects affect people (Bargh, 2006)

As such, creativity can be encouraged by objects as well. A clever study by Forster, Friedman, Butterbach, and Sassenberg (2005) primed students with artworks that were either conforming or rebellious in nature. The conforming artwork had twelve X’s of the same shape and color in 4x3 table. The deviant artwork had one different colored X in the table. People exposed to deviant art produced more creative ideas than those exposed to the conforming art.

More recently, a study used incandescent bulbs to stir creative problem solving in people (Slepian, Weisbuch, Rutchick, Newman, & Ambady, 2010). In this study, participants were led by the experimenter to a room. The room was initially dark until the experimenter turned on the fluorescent or incandescent light bulb. The later condition is associated with the concept of ideas: an incandescent light bulb depicted turning on near a person is representative of that person

having a good idea. As predicted, participants in the conditions in which an incandescent light bulb was lit solved more insight problems than those with a florescent light bulb. This was true for several kinds of insight problems, but this difference did not hold true for non-insight problems.

There is also evidence that the organization level of a room – using books and papers to make rooms look messy or tidy – affects creativity levels (Vohs, Redden, & Rahinel, 2013). Participants were guided to either a messy or tidy laboratory room. Experimenters asked participants to generate new uses of Ping-Pong balls. There were no differences in the number of ideas generated, but the messy room condition was associated with ideas that were rated more creative by blind judges.

Innovation in the real world

Many of the folklore methods to stir creativity have the right ideas. Design firms are well-known for trying to take advantage of items associated with creativity, especially during their brainstorming process. The brainstorming process typically takes place at the beginning of a product cycle and is meant as a way to get a viable idea or concept to develop. In fact, Port (as cited by Dahl & Moreau, 2002) believes that the ideas from the early stages determine 75-85% of the manufacturing and marketing costs in a project. As such, brainstorming is an important part of any project and needs to be done properly to avoid incurring the costs that come with changing a product.

In order to have what they believe is the most effective brainstorming, many designers follow a creed to generate as many ideas as possible. This stems from Alex Osborn's views on product development (Osborn, 1953). Not only does this give more choices from which to choose a concept, but trying to generate more ideas is seen as a way to encourage people to expand into unconventional areas. At this stage, quantity and uniqueness reign supreme. In the next phase, designers have to evaluate and analyze their ideas. Sometimes they even fuse ideas.

The former stage of generating as many ideas as possible is called the divergent phase of creativity (Finke, 1996; Guilford, 1967). Narrowing down the choices is the convergent stage. Much of the creative design folklore is around the divergent stage of brainstorming. For example,

there is folklore in design that a room full of candy and toys will help the brainstorming session go more smoothly.

There are two important differences between the method of priming shown in psychology and the method of priming in the product design world though. The first is that in psychology, the primes are often indirect and attention to how the prime affects a person's creativity is not explicitly indicated to the participant. The second is that psychology does not have much literature on creating an atmosphere using multiple objects. Many of the ideas used in the design world focus on the environment and not on using individual objects alone. Designers and their firms create environments in which to do their work that rely on many objects.

The design world seeks to make these environments such that they reliably produce creativity, but as a result of these differences in methods, there is little in existing psychology to support that firms are taking the right steps. The product developers might ask if it really takes a room full of toys and only toys to get the most creativity from people in a brainstorming session. This can be broken into two prominent questions: Does the level of creativity change with more than one toy? Can a conforming item such as a briefcase in the room counter the effect of the toy?

Unfortunately, the existing literature does not contain information about the former question: the relationship between multiple objects in the room to prime creativity. The Vohs, Redden, & Rahinel study is more about the overall impression the room gives instead of the specific items people notice (2013). To test the relationship between the objects used to prime creativity and creativity, an object with an established connection to creativity should be used. A survey done by Glaveanu (2011) shows a more ambivalent link between toys, childhood and creativity. Being prompted to "act like a 7 year old" has shown a spike in creativity (Zabelina & Robinson, 2010), but there are two key flaws for this study: 1) toys may not prime a specific idea about childhood and 2) the researchers asked students about what they would do with their time off if they were themselves or a child. This latter issue brings a confound of whether participants were simply thinking in terms of their realistic wishes or their wishes if they were to pretend they were a kid again which is inviting fantasy. The former issue is highlighted by Glaveanu's work

when some participants mentioned thinking that creativity comes with age and that children are not always creative.

There is a less ambiguous cue. The survey done by Glaveanu suggests a strong, direct link between art and creativity. More specifically, participants mentioned artistic items the most frequently. Besides Forester et al.'s (2005) study using conforming and deviant artwork, there has been no research to link artistic objects to creativity. As a result it is unknown if artistic items not related to deviance or conformance—such as paintbrushes which can create all sorts of possible artworks—can prime creativity.

This experiment seeks to look at these artistic objects and how they affect creativity. The link between art and creativity is assumed, but has never been demonstrated under experimental conditions. Additionally, people often create spaces for themselves that use multiple objects to aid their creative thinking. It is worth investigating how an immersive environment will affect creativity levels for tasks such as solving insight problems and generating ideas. To test this, participants will perform tasks that depend on creative thinking in rooms with various combinations of artistic objects visible. It is hypothesized that 1) artistic objects will induce participants to be more creative in terms of solving more problems and generating more ideas than neutral objects and that 2) multiple objects will act as a stronger prime and induce participants to be even more creative than when there is only one object.

There is a potential third variable in this experiment: experience with artistic expression. Leder, Bär, and Topolinski (2012) found that participants who were told to first paint in an abstract style are more inclined to rate abstract art higher than those who first painted in a more traditional style and vice versa. If the experience of painting in a style in an abstract or traditional style can affect people's preferences, then past experiences may have an effect on how strongly participants are primed by the stimuli. A person with more experience might more strongly resonate with the objects used and then be more creative. Therefore, people's experience with art and creating art will also be measured using a survey.

CHAPTER 2

METHOD

Participants

A sample of 84 (53 male, 31 female, average age = 21.40) undergraduate students participated in this study. They were recruited through an online system and compensated with course credit for an introductory psychology course along with being given an explanation of the study purpose and methods at the end. The participants were randomly assigned to one of the conditions.

Materials

Eight items were purchased for this study as use for primes: 4 objects designated as "artistic" – a sketchpad, a set of paint brushes, a box of crayons, and a blank canvas – and 4 objects designated as "neutral" – a pen, a stapler, a pack of printer paper, and a memo holder. The neutral items were chosen as a set of items that participants would frequently encounter in an office or school setting which is assumed to have no association to creativity. These items were placed on a table in front of the participants as part of the "workstation" area.

Additionally, the task materials were electronically created using Qualtrics (Qualtrics, 2013) and Microsoft Excel (Microsoft, 2013). Qualtrics was used for the demographic questionnaire, Brief Mood Introspection Scale (BMIS) (Mayer & Gaschke, 1988), the Remote Association Task (RAT) (Mednick, 1962; Shames, 1994), and the Artistic Experience Survey.

The demographic section consisted of 6 items. Two of the items were related to age and gender. The remaining questions were added after the initial participant based off of experimenter observation that language and cultural barriers may affect the results. The questions added related to how immersed in American culture a participant was (e.g. *how many years have you lived in the United States?*). Demographic questions were optional to answer. Appendix A contains a copy of the demographic questionnaire.

The BMIS scale consisted of 16 items for participants to rate on a scale of 1-4 of how much they feel like that mood item where 1 is “definitely do not feel” and 4 is “definitely feel”. Appendix B contains the BMIS scale and scoring.

The RAT task was a subset of 30 problems from the Shames version of the task which originally contained 60 items and is modified from Mednick (1962) and Bowers, Regeher, Balthazard and Parker (1990). In this section, participants were given three words and asked to find a fourth word that related them. For example, if they are given “blue, mouse, cottage” and they must answer the word “cheese” for their answer to be correct. In order to avoid ceiling and floor effects, a reasonable amount of time to complete this task was provided, ten problems were selected from the bottom, middle, and top most difficult items as provided by Shames such that participants in the zero object condition would be expected to solve 14.55 problems on average. Appendix C contains the RAT instructions and task.

Finally, the artistic survey was 10 questions. The first 2 questions asked for how many years of formal training and how often a participant goes to artistic events. The next 8 were scaled questions relating to personal experiences with art. Participants were asked to rate how strongly they agreed with a statement using a scale from -3 (*not at all*) to 3 (*very much*). Appendix D contains the Artistic Experience Survey.

Microsoft Excel was used by participants for the second task, which was an idea generation task. For this task, participants were given a prompt and asked to type ideas into the Excel table cells. Idea generation is a good contrast to the remote association task as solving insight problems is considered a convergence of thoughts while idea generation is more of a divergence in thoughts to achieve creative solutions (Finke, 1996). The prompts for the Idea Generation task can be found in Appendix E.

Altogether, the workstation consisted of the table where the participant sat, the laptop the participant used for the surveys and tasks, and the table directly in front with the objects meant to prime.

Procedure

At the beginning of the experiment, participants completed the original 4-point scale version of the Brief Mood Introspection Scale (BMIS). Appendix A contains this scale.

There were four conditions:

1. a control with no objects
2. a room with one art object visible. The art object chosen was counterbalanced between the paint brush, paint colors, a blank canvas and a crayon box.
3. a room with four office objects visible
4. a room with four art objects visible

Both the artistic and office objects were carefully set to be consistently placed at the edge of the table in front of the participants.

There were two tasks for the participants, done in a counterbalanced order. One task was an idea generation task. The participant had 15 minutes to generate as many ideas as possible on a topic given to them using a computer. The prompt read:

> "People often get into accidents while driving and texting. Generate as **many ideas as you can** to solve the problem of people driving and texting. These ideas should be based in reality, but do not have to be easy to implement. Please write your ideas into this excel sheet so a cell is a single idea. Also, please clearly describe them so your parents could understand it."

The participant then wrote their ideas into a form on a computer which was saved in an Excel file to their participant number. Every five minutes, the experimenter told the participants how much time they had left.

The second task was a remote association task (Mednick, 1962). For this task, participants must identify a word that relates all three words given to them. For example, if they are given "blue, mouse, cottage" and they must answer the word "cheese" for their answer to be correct. This task was administered using the same computer and used Qualtrics to store the data. The instructions read

"For this portion of the study, there will be three words presented. Your job is to find the one word that associates the three words. For example, what associates the words 'Cracker Union Rabbit'? The answer is "Jack" as in Cracker Jack, Union Jack, and Jack Rabbit. You would write Jack in the textbox. What about for 'Big Leaf Shade'? The answer is "Tree" which relates the ideas as trees are big, have leaves and provide shade. You have the rest of the 15 minutes to solve as many as you can. All of the questions are on this page."

The task consisted of 30 items chosen from Shames (1994). The list of items and exact instruction format are in Appendix B. T Participants were given 15 minutes. Every five minutes, the experimenter told the participants how much time was left.

At the end of the session was a brief questionnaire about how familiar students are with artistic expression using tools such as the ones on the desk. Appendix C contains these questions.

Analysis

Mood

Appendix A shows the items on the mood scale along with how the score is calculated.

Remote Association Task

The remote association task was scored as the number of problems solved. The solutions used were the ones given by Shames (1994). Qualtrics compared the answers given to the solutions and scored each item. The control group (No Object) was also compared to the probabilities found in Shames as a way to validate his work

Idea Generation Task

Measuring creativity is for idea generation tasks is less straightforward as there is no one solution. Traditionally, judges blind to the condition rate the solutions provided based on categories related to creativity on a numerical scale and then sum the results per category (Finke,

1996; Guilford, 1967; Mednick, 1962). However, the exact definitions and categories to judge widely differ. As the emphasis in this experiment for the idea generation task is measure divergent creativity (i.e. generate as much as possible), then the most appropriate measures are how many useful ideas a person generates (fluency) and how novel those ideas are on average (novelty). In equation form:

$$\text{Creativity} = (Number\ of\ useful\ ideas) + \frac{\sum Novelty\ score\ of\ each\ idea}{Number\ of\ useful\ ideas}$$

For the analysis, the participant solutions were presented in a random order to each judge who was blind to which idea is from which participant. First, judges determined whether an idea was useful or not useful to solve a problem. Then, each idea was scored for novelty on a scale from 1 (not novel at all) to 7 (very novel). The total number of useful ideas was generated. The final novelty score was a sum of all of the novelty points divided by the total number of useful ideas generated. Finally, a participant's creativity score for the idea generation task was the average score between the judges. Interjudge reliability was calculated through Pearson's correlation to be sure the judges had consensus on their generation creativity score (Cohen, 1988).

Artistic Familiarity

Appendix C shows the items on the artistic scale along with how the score is calculated.

CHAPTER 3

RESULTS

Data from 84 participants was collected and 81 were used in the data analysis. Three participants were determined to be outliers by using the 1.5*Interquartile Range rule. This left 20 participants in the No Object, 19 in the Four Office, 21 in the One Art, and 21 in the Four Art conditions.

Mood

Table 1 reflects the average score on the BMIS Pleasant-Unpleasant Scale. Higher scores represent more pleasant moods. There was no significant difference between groups $F(3, 77) = .654$, $p=.58$. The lack of significance implies that there was no discernable difference in mood between the conditions.

Table 1 – Average BMIS Score for Each Group

Conditions	Average Score (Standard Deviation)
No Object	49.20 (6.05)
Four Office	47.00 (4.83)
One Art	49.99 (5.00)
Four Art	48.42 (5.38)

Remote Association Task

Table 2 shows the average number of items solved for each group. A one-way ANOVA showed no significant difference between conditions for the RAT score ($F(3,77)= 1.019$, $p= .389$).

Table 2 – Average Number of Items Solved on the Remote Association Task for Each Group

Conditions	Number Solved (Standard Deviation)	Shames Expected Number
No Object	8.65 (6.17)	14.55
Four Office	11.16 (5.37)	
One Art	8.38 (5.16)	
Four Art	10.00 (5.67)	

Idea Generation

The generation scores from each judge were significantly correlated at $r(81)=.738$, $p<.001$. This significant and high correlation signifies that the scores between judges are not random. In other words, if one judge rated an idea higher than the other, the other judge was likely to do the same. Table 3 shows the average scores for each group in terms of generation, fluency, and novelty.

For generation creativity, there was no significant difference between groups $F(3, 77) = .430$, $p=.732$. There was also no significant difference for fluency ($F(3, 77) = .221$, $p=.882$) or novelty ($F(3, 77) = .340$, $p=.796$). These imply that there is no difference between conditions in performance on the idea generation task.

Table 3 – Average Generation Scores for Each Group

	Means (Standard Deviation)		
Conditions	Average Generation	Average Fluency	Average Novelty
No Object	10.60 (3.86)	6.22 (3.87)	27.61 (20.80)
Four Office	10.35 (4.00)	6.81 (3.65)	24.50 (12.96)
One Art	11.55 (5.15)	7.24 (4.48)	29.57 (20.24)
Four Art	11.51 (3.70)	7.50 (4.05)	27.97 (27.83)

Artistic Score

Table 4 shows the average Artistic score between groups from the list of items in Appendix C. A one-way ANOVA revealed no significant difference between conditions for the RAT score ($F(3,77)= 2.393$, $p= .075$).

Table 4 – Average Self-Rated Artistic Score between Groups

Conditions	Artistic Score (Standard Deviation)
No Object	40.90 (11.85)
Four Office	33.00 (8.08)
One Art	35.90 (10.92)
Four Art	40.14 (11.24)

Overall Correlations between Measures

The correlations between the generation score, remote association task score, mood and artistic expression are expressed in table 5. The creativity score from the idea generation task is significantly and positively correlated to the RAT creativity score ($r(81)=.313$, $p=.004$) and to the BMIS score ($r(81)=.255$, $p=.021$), but there are no other significant relationships including no significant relationship between the RAT and BMIS scores.

Table 5 – Table for Correlations (Significance) between Measures

	Generation	RAT	Mood	Artistic Experience
Generation	1.00	**.313 (.004)**	**.255 (.021)**	.090 (.423)
RAT		1.00	.056 (.618)	-.111 (.323)
Mood			1.00	-.017 (.883)
Artistic Experience				1.00

Years in the United States

Further analysis was conducted on the number of years participants spent in the United States. The number of years was a demographic item added based off experimenter observation and was an optional item. Of the 84 participants, 81 answered this item. Figure 3 shows a scatterplot of the number of years someone lived in the US versus their RAT score and Figure 4 shows a scatterplot versus their Idea Generation score. Table 6 then reports the overall correlations. Tables 7 and 8 show partial regressions of previously significant correlations now factoring in this variable.

These correlations show significant correlations between the Idea Generation score, the RAT score, and the number of years a participant has lived in the United States. The relationship between the Generation score and RAT score is moderate ($r(79)=.324$, $p=.003$) as found above. The relationship between Idea Generation and years lived in the US is also moderate ($r(79)=.358$, $p=.001$). The relationship between the Remote Association Task and number of years in the US is slightly stronger ($r(79)=.666$, $p=.000$).

The partial correlation table using Years in the US and Idea Generation to predict a participant's RAT score shows that when taking each other into account, the number of years a participant has lived in the US remains a significant predictor for a participants RAT score ($t(79)=6.944$), $p<.001$) whereas the participant's Idea Generation score does not ($t(79)=1.079$), $p=.284$).

Finally, table 8 shows the partial correlation table predicting a participant's Idea Generation score from number of years they lived in the US and mood. Whereas mood significantly correlated with the Idea Generation score, it is not a significant predictor when taking the number of years spent in the US into account ($t(79)=1.746$), $p=.085$). The number of years spent in the US, however, is a significant predictor of a participant's Idea Generation score ($t(79)=2.636$), $p=.01$).

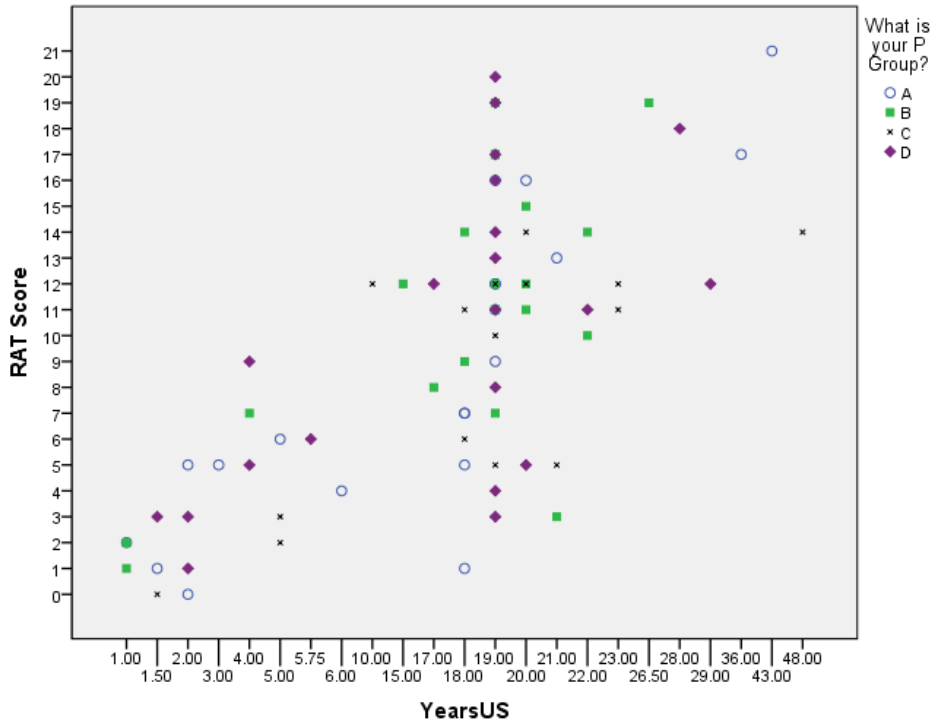

Figure 3. Rat Score by Years Lived in the US and Condition

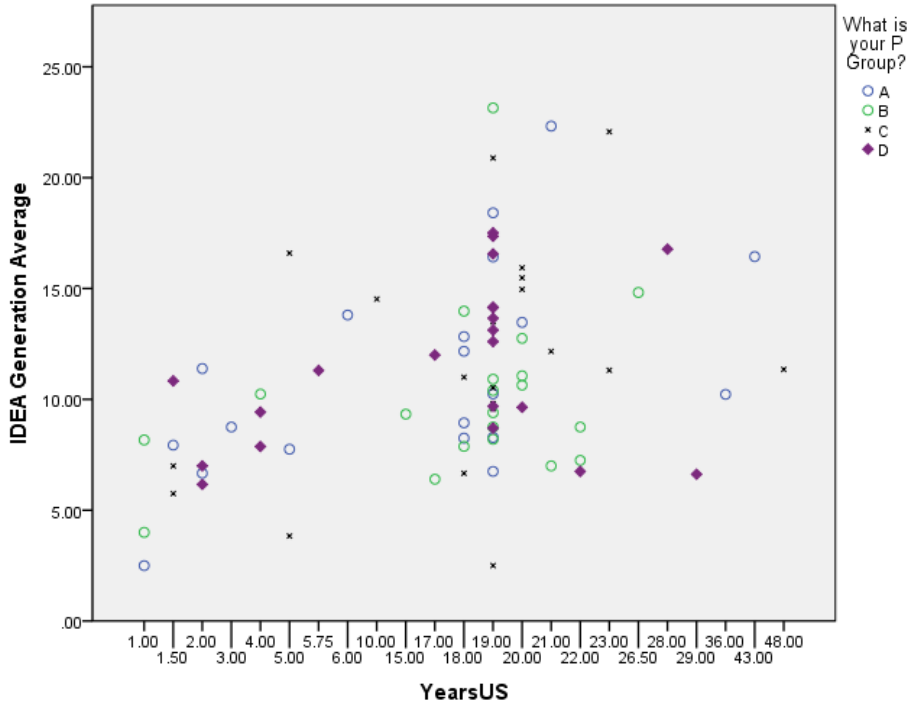

Figure 4. Idea Generation Score by Years Lived in the US and Group.

Table 6 – Table for Correlations (Significance) between RAT scores, Idea Generation, and Years in the US

	Generation	RAT	Years in US
Generation	1.00	**.324 (.003)**	**.358 (.001)**
RAT		1.00	**.666 (.000)**
Years in US			1.00

Table 7 – Regression Table for Partial Correlations predicting RAT scores from Idea Generation and Years in the US

	Standardized Coefficients		t	Sig.
	Beta	Std. Error		
(Constant)			1.119	.267
Years in the US	**.631**	.091	6.944	**.000**
IDEA Generation	.098	.091	1.079	.284

Table 8 – Regression Table for Partial Correlations predicting Idea Generation from Mood and Years in the US

	Standardized Coefficients		t	Sig.
	Beta	Std. Error		
(Constant)			.581	.563
Mood	.194	.111	1.746	.085
YearsUS	**.293**	.111	2.636	**.010**

CHAPTER 4

DISCUSSION

General Discussion

There was no effect of artistic on creativity was not found during this study. There were no significant differences among conditions in terms of the Generation Creativity score or the RAT Creativity score. There also no significant differences in the population in each group in terms of mood or how familiar with art people rated themselves.

These results suggest that artistic objects do not add to creativity. Unfortunately, since neither of the art conditions yielded any more creativity, the results do not reveal much about how multiple cues for the same thing interact. At best, this study suggests having multiple cues for the same thing does not stifle creativity nor do office objects. Of course, it could be that the design of the study was not controlled to provide adequate sensitivity to distinguish conditions. A few participants in the One Art condition mentioned not seeing the object when the experimenter debriefed them. This could be the result of a large room that created a lot of distraction.

However, it is noteworthy that the RAT scores from all groups are below the predicted values from Shames which would have expected 14.55 items to be solved for the no object condition. This can be coupled with an observation by the experimenter: people who have spent less time in the United States seem to have a harder time solving the puzzles presented in the Remote Association Task. Further analysis of those who reported their years shows that this relationship is supported ($r(79) = .666$, $p<.001$). People who have spent less time in the United States may understand fewer of the words on the test, but also may lack some of the same associations between words, having other associations. Those who were in the United States less than 10 years spoke native languages such as Spanish and Swedish. Between conditions, there was no significant difference in the number of years ($F(3,75) =.280$, $p= .840$).

More surprisingly, the number of years a participant reported living in the US also correlated significantly with the Generation score ($r(79)= .359$, $p= .001$). This further analysis is interesting, as it poses the question: is creative problem solving dependent on cultural experiences? The idea of texting and driving is not complicated overall, but people who have

spent more time in the United States scored higher on this task. This echoes a question by designers about “imperial design” and whether those from the first-world countries can solve problems in third-world countries (Nussbaum, 2010). Isolating this factor and testing could yield interesting results. If culture does play an important part in creative problem solving, then governments and others seeking to employ a designer need to keep that in mind when hiring. It would also imply that creativity research needs be more careful on task design as to avoid floor effects and properly compare groups.

The number of years a participant reported living in the US also correlates significantly and positively with mood ($r(78)= .324$, $p= .003$). At the same time, mood did not correlate significantly with solving the RAT insight problems, but mood did correlate with a moderate slope with the Idea Generation score ($r(81)=.255$, $p=.021$).Upon further analysis, however, the partial regression revealed that while taking each other into account, mood is not a significant predictor of a participant’s Idea Generation score ($t(79)=1.746$), $p=.085$), but the number of years spent in the US is a significant predictor ($t(79)=2.636$), $p=.01$).

This is a complicating factor to the study. Pleasant moods are known to correlate to creativity (Isen, Daubman, & Nowicki, 1987). It is possible that participants who have lived longer in the United States are happier and thus more creative—particularly in a divergent way of thinking. However, for this study, mood did not significantly predict creativity. Perhaps this relationship is possible through another known effect: people from Western cultures tend to rate themselves higher subjectively even though they may not actually be happier (Diener, Suh, Smith, & Shao, 1995). This effect stems from Western cultures as liking extremes more than Eastern cultures which prefer that people stay neutral when self-reporting mood. Although ethnic identity was not collected, of the 17 participants who have lived in the US less than 10 years, only two reported English only as their most comfortable language. One participant reported Norwegian along with English, one reported Turkish along with English, 6 were Arabic or Arabic along with English, and the remaining seven were unreported. This opens the discussion to this possibility that nationality had an effect on happiness. Finally, though significant, the correlation between scores from the Remote Association Task and Idea Generation tasks were only

correlated with a moderate slope ($r(81)=.324$, $p=.003$). After taking into account the number of years spent in the United States, they were not significantly correlated ($t(79)=1.079$, $p>.10$). This implies that the two types of creativity they were measuring, convergent (RAT) and divergent (Idea Generation), may be unrelated or at least affected differently. In which case, that would suggest creativity has several aspects to it and may be too broad of a catch-all term. Overall then, this study has seemingly poked a few holes into the definition and measurement of creativity. For the product design world, one cannot confidently apply the same regarding objects that inspire insight problem solving to what inspires prolific idea generation.

Further Exploration

This study is one of the first to investigate how multiple primes interact. Unfortunately, the design did not allow for such analysis and needs to step back to examine what kind of artistic objects, if any, do prime creativity. Still, in addition to examining how multiple of the same interact, it would be great to extend on these ideas and see how primes that suggest the same effect but are not the same would affect participants (e.g. a toy, a paintbrush, a galaxy model and a light bulb). It would also be enlightening to study how and when contradictory primes interact (e.g. a briefcase in the room with three artistic items).

At a higher level, the relationship between psychological distance and physical neural networks is interesting. As mentioned before, there is evidence that the brain's imagination and creation of novel ideas relies on physically separate pathways (Schlegel, Kohler, Fogelson, Alexander, Konuthula, & Ulric Tse, 2013). Looking at fMRI data for unprimed and primed problem solvers might illuminate the connection of insight from restructuring and actual physical activity and structure. It is possible that repeated primes can have physical manifestations in strengthening pathways.

An interesting item in the literature relates back to the association of guns and aggressive behavior. Anderson, Benjamin, and Bartholow (1998) reported a study in which in the first experiment participants were primed with words related to guns and in the second, they were primed with a picture. Interestingly, the word condition yielded a larger effect on participants than

the picture condition, despite the pictures being more concrete. Examining the relationship between the saliency of objects in the room and the effects on creativity would be worthwhile. This same effect with artistic objects is especially compelling as the study would suggest word puzzles or traditional priming would possibly have an effect even though this study found no relationship.

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APPENDIX A

DEMOGRAPHIC QUESTIONNAIRE

1. What is your age?

2. What is your gender?

- ❍ Male
- ❍ Female
- ❍ Other
- ❍ Prefer Not to Answer

3. Are you an international student?

- ❍ Yes
- ❍ No

4. How many years have you lived in the US?

5. How many years have you lived in the UK?

6. What language are you most comfortable speaking?

APPENDIX B

BRIEF MOOD INTROSPECTION SCALE (BMIS)

INSTRUCTIONS: Circle the response on the scale below that indicates how well each adjective or phrase describes your present mood.

(definitely do not feel)	(do not feel)	(slightly feel)	(definitely feel)
XX	X	V	VV

Lively	XX	X	V	VV	Drowsy	XX	X	V	VV
Happy	XX	X	V	VV	Grouchy	XX	X	V	VV
Sad	XX	X	V	VV	Peppy	XX	X	V	VV
Tired	XX	X	V	VV	Nervous	XX	X	V	VV
Caring	XX	X	V	VV	Calm	XX	X	V	VV
Content	XX	X	V	VV	Loving	XX	X	V	VV
Gloomy	XX	X	V	VV	Fed up	XX	X	V	VV
Jittery	XX	X	V	VV	Active	XX	X	V	VV

Scoring

1. Convert the Meddis response scale (XX, X, V, VV) to numbers:

- XX = 1
- X = 2
- V = 3
- VV = 4

2. Add up the responses for: Active, Calm, Caring, Content, Happy, Lively, Loving, and Peppy.

3. Reverse score the responses for: Drowsy, Fed up, Gloomy, Grouchy, Jittery, Nervous, Sad, and Tired. That is, recode, such that:

- XX = 4
- X =3
- V = 2
- VV = 1

4. Add up the regular and reverse-scored items. That is the total on the Pleasant-Unpleasant scale.

APPENDIX C

REMOTE ASSOCIATION TASK

For this portion of the study, there will be three words presented. Your job is to find the one word that associates the three words. For example, what associates the words “Cracker Union Rabbit”?

Cracker Union Rabbit	

The answer is “Jack” as in Cracker Jack, Union Jack, and Jack Rabbit. You would write Jack in the textbox. What about for ‘Big Leaf Shade’?

Big Leaf Shade	

The answer is “Tree” which relates the ideas as trees are big, have leaves and provide shade. You have the rest of the 15 minutes to solve as many as you can. All of the questions are on this page.

	Triplet	**Solution**
1.	Stick Light Birthday	
2.	Puss Tart Spoiled	
3.	High Book Sour	
4.	Hall Car Swimming	
5.	Widow Bite Monkey	
6.	Salt Deep Foam	
7.	Broken Clear Eye	
8.	Snack Line Birthday	
9.	Sore Shoulder Sweat	
10.	Sandwich Golf Foot	
11.	Ache Hunter Cabbage	
12.	Jump Kill Bliss	

13. Athletes Web Rabbit

14. Mouse Sharp Blue _____

15. Barrel Root Belly _____

16. Note Dive Chair _____

17. Playing Credit Report

18. Actor Dust Shooting _____

19. Rock Times Steel _____

20. Ticket Shop Broker _____

21. Chocolate Fortune Tin _____

22. Inch Deal Peg _____

23. Water Tobacco Stove _____

24. Strike Same Tennis _____

25. Pure Blue Fall _____

26. Envy Golf Beans _____

27. Manners Round Tennis _____

28. Time Hair Stretch _____

29. Magic Plush Floor _____

30. Gold Stool Tender _____

APPENDIX D

ARTISTIC SELF-EVALUATION

How many years have you been educated formally in painting and/or drawing?

- ❍ 0 years (1)
- ❍ 1 year (2)
- ❍ 2 years (3)
- ❍ 3 years (4)
- ❍ 4 years (5)
- ❍ 5 years (6)
- ❍ 6+ years (7)

How many times have you visited galleries/art museums in the past 3 years (including repeated trips)?

- ❍ 0 (1)
- ❍ 1 (2)
- ❍ 2 (3)
- ❍ 3 (4)
- ❍ 4 (5)
- ❍ 5 (6)
- ❍ 6+ (7)

For the following questions, please rate how much you agree with each statement using a -3 to 3 scale where -3 is “not at all”, 0 is “neutral” and +3 is “very much so”/”very often”.

	-3 (not at all) (1)	-2 (2)	-1 (3)	0 (neutral) (4)	+1 (5)	+2 (6)	+3 (very much) (7)
I am skilled in painting and/or drawing.	❍	❍	❍	❍	❍	❍	❍
I dislike creating art that involves painting or drawing.*	❍	❍	❍	❍	❍	❍	❍
The rest of my family is skilled in creating art relative to other families.	❍	❍	❍	❍	❍	❍	❍
I often create art involving painting or drawing nowadays.	❍	❍	❍	❍	❍	❍	❍
I cannot express myself	❍	❍	❍	❍	❍	❍	❍

well using painting or drawing relative to others.*							
Drawing and/or painting play a large role in my life.	❍	❍	❍	❍	❍	❍	❍
I painted often when I was a child.	❍	❍	❍	❍	❍	❍	❍
When I was a child, I did not draw or color often.*	❍	❍	❍	❍	❍	❍	❍

*these items were reversed scored

APPENDIX E

IDEA GENERATION TASK

People often get into accidents while driving and texting. Generate as **many ideas as you can** to solve the problem of people driving and texting. These ideas should be based in reality, but do not have to be easy to implement. Please write your ideas into this excel sheet so a cell is a single idea. Also, please clearly describe them so your parents could understand it.

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