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Previous research has suggested that categorical organization of information increases the likelihood of it being remembered on a later memory task (Calfee & Peterson, 1968). Additionally, Slamecka and Graf (1978) found that if participants were forced to generate portions of words they were more likely to remember the words on a later test. The main point of interest for this experiment was whether providing participants with an organizational strategy, (Prescribed Organization-PO), in comparison to allowing them to freely choose how they want to organize information, (Choice Organization-CO), affects the participants' scores on short-term recognition tests of that information. This study was unique due to the pictorial nature of the materials. The materials were created for this study and have not been employed in any previous research. The results of this study indicate that presence or absence of organizational instruction had no significant effect on short-term recognition of information. However, it was discovered that when using a CO strategy it is more beneficial to use more than one level of organization for the information being studied.

There are many choices involved in the learning process, many of which pertain to the type of organization people decide to enforce upon the information they wish to learn (Mandler & Rabinowitz, 1983). There is a vast amount of research in the field of learning, memory, cognition; however, there is little recent research investigating how the organization of information influences how well it is then recognized on a memory task.

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Slamecka and Graf (1978) investigated what they called "The Generation Effect." In this study they had participants remember related word pairs. In one condition participants would simply read the related words pairs in an attempt to memorize them. In another condition participants were given the first word and the first letter of the second word in the pair. The remainder of the second word was left for the participant to "generate." Slamecka and Graf (1978) found that when the remainder of the second word in the pair was left blank, and then "generated" by the participant, it was recalled more.

Foos, Mora, and Tkacz (1994) also investigated the generation effect. In their study they had individuals and small groups read material that they knew they were going to be tested over. They then provided some individuals with an outline of the material to study and others were told to generate their own outline for the material. Other groups were given sets of study questions based on the material, and other were told to write their own study questions for the material. Students who generated their own material were not told how extensive their materials needed to be. Students returned two days later to take a test over the material they read. Foos, et al. (1994) found that when students were forced to generate their own study materials a generation effect occurred thus increases their recall of generated items.

A study by Calfee and Peterson (1968) used word lists with random or blocked presentation to test the effects of organization on short-term recall. The lists with random words

were comprised of words with no noticeable connection to one another. The lists with blocked presentation were comprised of words that all shared some obvious connection to one another. They also had conditions where the category name presentation prior to the test was manipulated to see if having a category title in mind would help increase recall. The results of the study showed that short-term recall of a list of words was increased when words were presented organized by category.

Additionally, a study by Strand (1975) investigated how providing category names in instructions influences retention of lists of words over a several day period. The results of this study showed that instructing participants to use experimenter defined categories in learning a free-recall list can reduce forgetting over a several day period. Strand (1975) then posited that the limiting nature of including category names in the instructions would lead to fewer retrieval cues that needed to be remembered, thus easing the process of storing and accessing the cues and information at a later time.

A more recent study by Kinjo and Snodgrass (2000) looked specifically at the generation effect as it pertains to pictures. This relates directly to my current investigation because pictures were used as the main stimuli for participants to study. In this study participants were presented with pictures with incomplete names, as well as some items with full names. Participants would either generate the remainder of the name or read the full name provided. Participants were then

immediately shown the correct name with the corresponding picture. The findings of this study showed a significant generation effect, suggesting that generating names for pictures increases later correct recall of the picture and name.

The present study aims to investigate how instruction for categorical organization of information influences performance on a short-term memory recognition test. This study can be differentiated from previous investigations of the relationship between memory, categories, and the generation effect because of the pictorial nature of the study materials. Most previous research as relied on the use of word lists or word pairs. However in this study the use of cards with varying colors, number of items, and item type were utilized. The primary investigator hypothesized that allowing participants to decide how to categorically organize the cards instead of explicitly instructing them how to do so would allow for greater performance on a short-term recognition test.

Method

Participants and Design

Participants (n=22) for this study were Lindenwood University, undergraduate students recruited through the Lindenwood Participant Pool (LPP). Eligibility to participate in the LPP requires that a participant be at least 18 years of age or have a signed parental consent form on file at the LPP office. LPP participants also must be enrolled in a participating, introductory level

anthropology, sociology, psychology, athletic training, or exercise science course at Lindenwood University. Participants were compensated for their participation with one LPP credit, which resulted in extra credit in their participating introductory level class. Participants signed up to participate for this study through Sona Systems, a website that organizes scheduling, sign-ups, and participation.

This experiment was a 2 (Prescribed Instruction) x 2 (Deck) x 2 (Organization Strategy) Mixed Factorial Design. Prescribed Instruction was a between participant factor that split participants into two groups, Instructions1 (n = 11) and Instructions2 (n = 11) (see Appendix A for Instructional script). Participants were assigned to one of the two Prescribed Instruction groups by alternating group assignment for each participant. The other two factors (Deck and Organization Strategy) were within participant. The order and combination in which participants were presented with these two factors (Deck and Organization Strategy) was controlled for by randomly assigning participants to one of four possible trial sequences (see Appendix B for table breakdown of sequences).

Materials

The main materials used for this experiment were two decks of cards (Deck A and Deck B) and two corresponding tests (see Appendices C and D for tests). Each deck of cards was comprised of 18 cards (see Appendix E for sample cards). To create the cards the random

number function in Microsoft Excel was used to randomize lists of possible card items, quantities, and colors. The possible card items were comprised of numbers (0, 1, 2, 3, 4, 5, 6, 7, 8, and 9), animals (pig, lion, chicken, elephant, and rabbit), and shapes (circle, star, triangle, and pentagon). The possible quantity of card items for each card ranged from one to five. One of seven possible item colors (red, pink, orange, yellow, green, blue, or purple) was assigned to each card. A total of 38 cards were randomly generated using this method, 19 for each deck. However, only 18 cards were used in each deck. The 19th card served as an alternate that would take the place of any card duplicate (card with the same item, quantity, and color) that occurred in the deck. The items for the cards were then printed, cut out, and pasted on to blank 3" x 5" index cards. The deck name (A or B) was written lightly on the back of each card with pencil. Each card was then laminated to protect the cards from sustaining stains or defects.

As previously mentioned, each deck had a corresponding test. Both tests had 25 items, 7 false (cards not in the deck) and 18 true (cards in the deck). The same method that was used to create the cards for each deck was used to create 14 false items. To determine the order of the 18 true and 7 false items within each test (see Appendices C – D for tests) the random number generator in Microsoft Excel was used.

An informed consent form (see Appendix F for form) was used to record each participant's consent for the experiment. These consent forms also gave participants a general

overview of what would be expected of them. This form informed participants of the voluntary nature of the experiment, which granted them the right to end their participation at any time without penalty. Additionally, a feedback letter (see Appendix G for letter) was used in this study to provide additional clarity regarding the purpose of the experiment and posited hypotheses. This letter also included the experimenter and faculty advisor's contact information, and made it clear that if any questions arose they could be contacted with the information provided. A script (see Appendix A for script) was also composed and read to each participant to ensure consistency of instruction for all participants. Lastly, a demographic survey (see Appendix G for survey) was written for this study and was comprised of three questions. This survey was used to gather information about the demographics of the participants, as well as information regarding decisions made during the course of the experiment.

Forms provided by the LPP were also used in this experiment. These forms included, experimenters running list of participants, absence without notification form, room booking request form, and participant receipts. These forms were all written by the LPP. Their main functions were to provide paper documentation of participation or absences. The receipts were used to ensure that participants received credit for their participation. Sona Systems was used in addition to the LPP paper forms in this study to post timeslots and allow participants to sign-up. This online system was also used to grant credit to participants.

Participation for the study occurred in the Lindenwood Psychology Lab. This lab is comprised of four different rooms. These rooms allowed for privacy, and served as a barrier between the participant and external distractors. The rooms have white walls with no décor or windows and contained at least two tables with large surface areas.

Procedure

Participants signed up to participate in this study using Sona Systems. When the participants arrived at the lab they were greeted and asked to sign in on the experimenter's running list of participants. The participants were then given two copies of the informed consent form (see Appendix F for form). The participants were asked to carefully read the form. Once completed, participants would then print, sign, and date their name on both copies, acknowledging that they understood what was expected of them and the voluntary nature of the experiment. Next, participants were read a script (see Appendix A for script), which gave a brief overview of the entire experiment.

Two different card decks (Decks A and B), each containing 18 cards, and each card depicting different quantities of shapes, numbers, and animals, in various colors were used for this study. All participants were tested once with each deck, and once under two different conditions: Prescribed Organization (PO) and Choice Organization (CO). The order in which the participants went through these two conditions was counterbalanced, and the deck associated

with each condition was also counterbalanced across participants. A total of four different trial sequences were employed (see Appendix B for table breakdown of sequences) and randomly assigned to participants.

In the PO condition, participants were specifically instructed how organize the cards. The specific prescribed instructions provided alternated between participants. For Instructions1 participants were told to organize the cards based on the "number of items on each card". For Instructions2 participants were told to organize the cards based on the "type of item on each card" (see Appendix A for script). The participants were then given 1-min to organize the cards according to the instructions. Once the 1-min was up the experimenter told participants that they had 30 s to study the cards. Once the 30 s was up the experimenter removed the cards from the table and gave the participant the corresponding test (see Appendices C – D for tests).

In the CO condition, participants employed a choice organization strategy. In this condition participants were told to organize the cards in "whatever way made the most sense to them" (see Appendix A for script). The participants were then given 1-min to organize the cards in whatever way they pleased. Once the 1-min was up the experimenter told participants that they had 30 s to study the cards. Once the 30 s was up the experimenter removed the cards from the table and gave the participant the corresponding test (see Appendices C – D for tests).

After both trials were complete each participant filled out a three question demographic survey (see Appendix G for survey). Participants were then be debriefed and given a feedback letter (see Appendix H for letter).

Data Analysis

The tests were graded using a Microsoft Excel spreadsheet. Items that were circled, indicating it had been recognized, received a "1", and items that were not circled received a "0". The sum for all of the correct test items was then calculated. Inferential and descriptive statistics for the data were completed using SPSS software.

Results

A paired samples *t*-test was run to examine the data gathered from 22 participants (n = 22). This test was used to compare test results for the two conditions (PO and CO). The results showed no significant difference between PO (M = 11.682, SD = 3.123) and CO (M = 12.273, SD=3.3691) conditions, t (21) = -.777, p = .446. This suggests that any differences in the data are most likely due to chance or individual differences.

An additional analysis was run to see if the complexity of the CO strategy used by participants, as described on the survey, led to statistically significant differences on the CO condition test scores. Two individuals coded the data to the free response survey question, which indicated how participants organized the cards during the CO condition, and interrater reliability

of 100% was reached. Responses were coded to reflect the number or organizational (categorical) levels used by participants during the choice organization condition. An example of a survey response indicating a one-level organization strategy would be "I organized the cards by color." An example of a survey response indicating a two-level organization strategy would be: "I organized the cards by item category (animals, number, and shapes) and then put each category in order based on the item quantity for each card."

An independent samples *t*-test with equal variances assumed was run on the two groups (CO using one organizational level and CO using two organizational levels). The results showed that there was a significant difference (t (20) = -2.237, p = .037) between the mean test scores for those who used one level of organization (M = 11.267, SD = 3.3051) and those using two levels of organization (M = 14.429, SD = 2.507) as their CO strategy. These results indicate that those who used two levels of organization during the choice organization strategy correctly recalled more than those using only one level of organization.

Discussion

The results of this study do not support the previously mentioned hypothesis. Therefore, I failed to reject the null hypothesis that organization strategy, prescribed or choice, has no significant effect on short-term recognition of information. These results suggest no significant difference in short term-recognition when using PO and CO strategies. These results could

potentially be due to the fact that previous research has suggested that providing category titles increased recall of items in the category, but previous research also suggests that allowing people to generate information increases recall as well (Strand, 1975). In the PO condition participants were given instructions defining how the cards were to be organized. In the CO condition participants generated their own categories. Could it be possible that the benefits of these two different strategies are equivalent? I believe that in future research a control group would be necessary to suggest that any benefit of CO and PO strategies exist, and then the means between CO and PO strategies should be compared. This control group would simply present participants the cards to study after they have already been randomly laid out. Therefore the participants in this group would not receive the benefit of category titles provided by the instructions in the PO condition or the benefit of generating their own categories in the CO condition. We can then compare the CO and PO groups to this control to see if either has a benefit over simply being presented with the information.

The results concerning the level of CO strategy complexity indicate that two levels of organization during CO strategy use produce significantly higher average recall scores on the short-term recognition task then using only one level of organization. Possible explanations for these results may be due to the increased levels of processing involved in more complex

organization of information. Increased levels of processing with the use of pictorial stimuli should also be investigated as part of future research.

These results need to be interpreted with caution. Limitations for this study were the relatively small sample size and the use of untested materials. Future research should in general explore advantageous study strategies, with regards to how information is organized prior to studying when no instruction is given. Additionally, future studies should focus on longer-term recognition to make results more ecologically valid and relatable to real classroom environments. Lastly, the materials used in the study should be reworked to appear more similar to pictures or diagrams that are used in typical classroom settings to hopefully increase generalizability.

References

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Appendix A

Script

" There are two parts to this study. For each part you will be given a deck of cards. You will have 1 minute to organize the deck of cards. When organizing the cards you should lay the cards so that you can see each one clearly. You will then have 30 seconds to study the cards. Finally, you will be tested over the deck of cards. Do you have any questions before we begin?"

Prescribed Organization condition:

- Instructions1: "Please organize the cards into groups based on the number of items on each card."
- Instructions2: "Please organize the cards into groups based on the category of the items on each card."

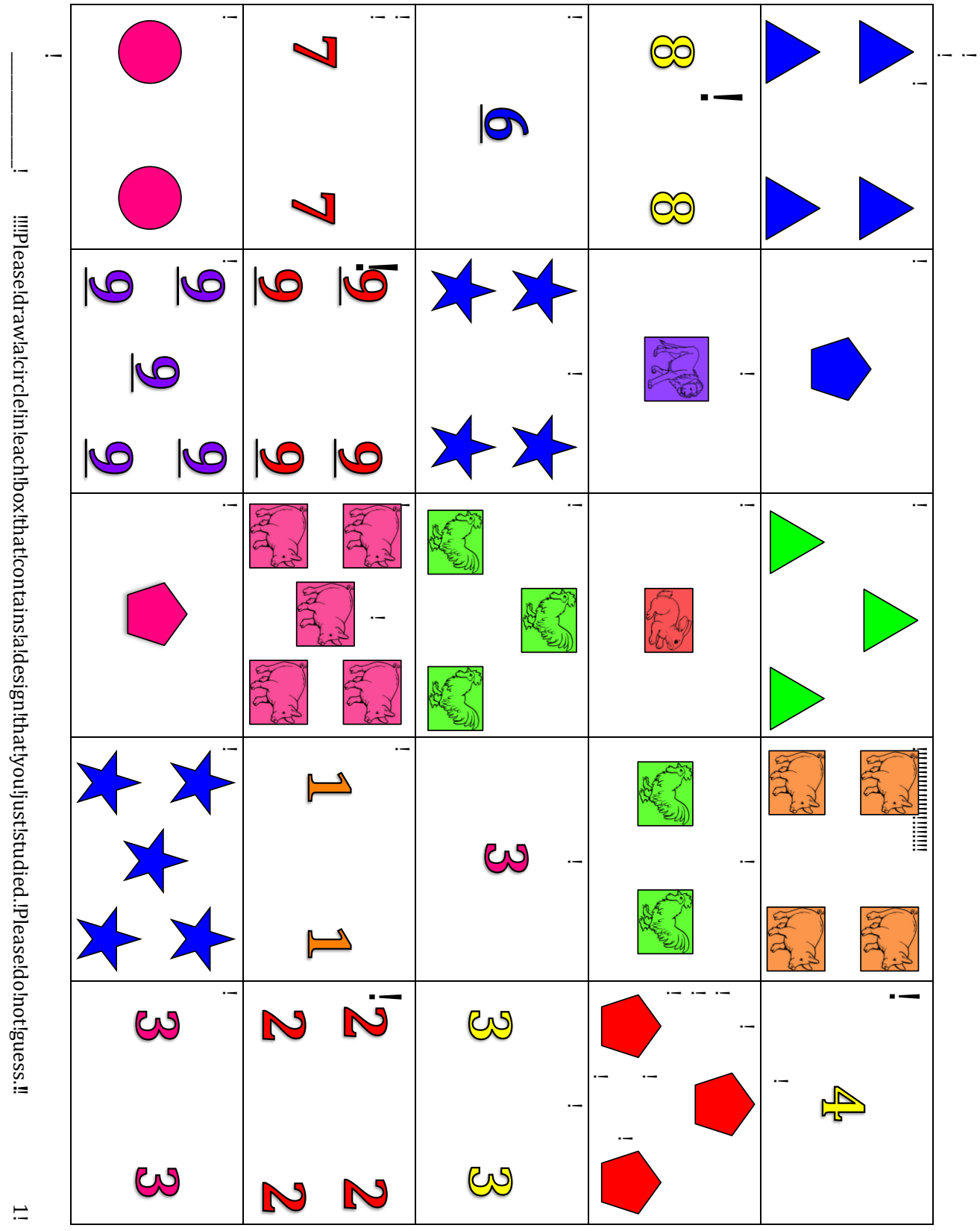
Choice Organization condition:

"Please organize the cards in a way that would make it easiest for you to remember them."

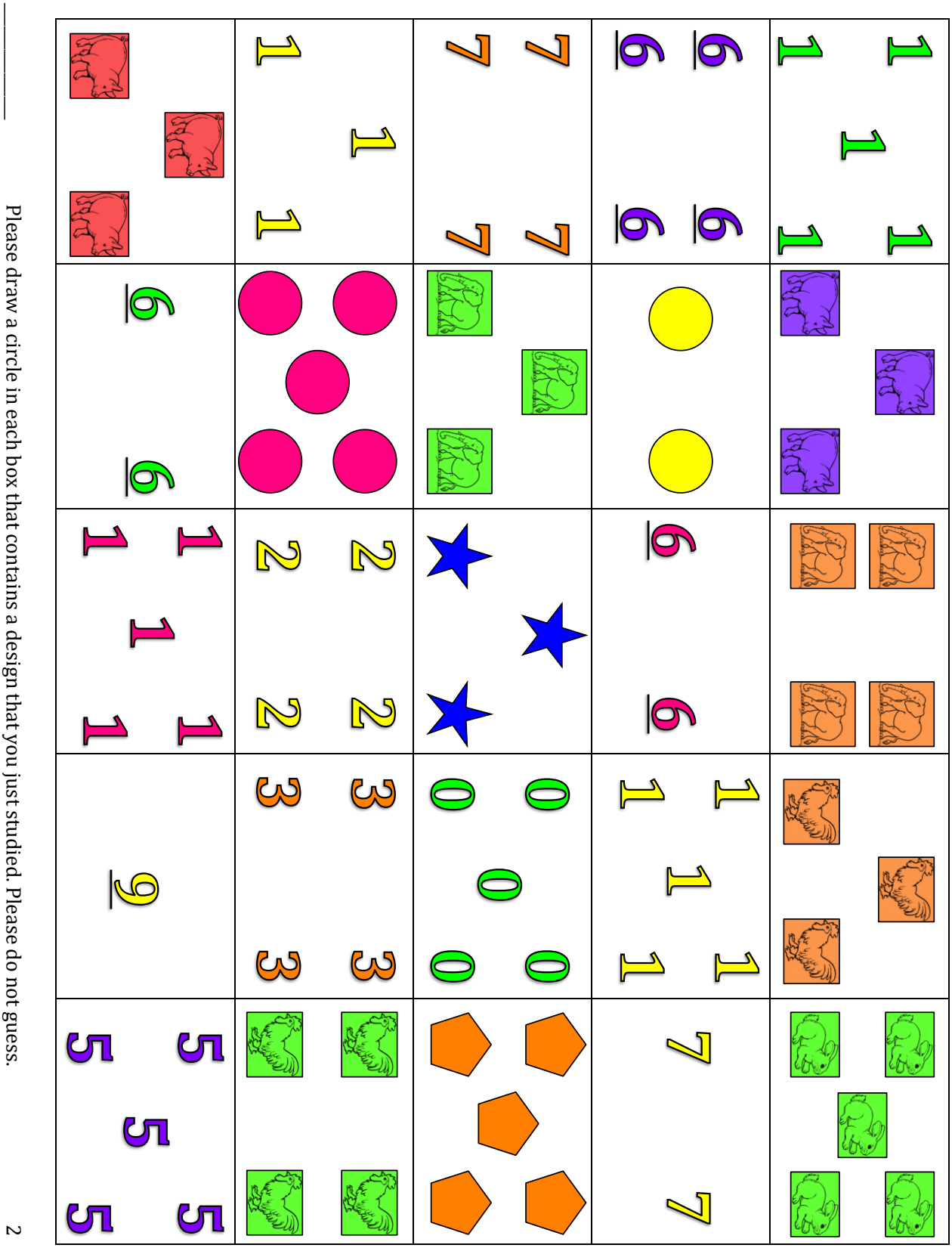
Appendix B

Trial Sequence	Trial 1	Trial 2
1	PO condition with Deck A	CO condition with Deck B
2	PO condition with Deck B	CO condition with Deck A
3	CO condition with Deck A	PO condition with Deck B
4	CO condition with Deck B	PO condition with Deck A

Appendix C


!!!!PleaseldrawlalcirclelinleachlboxlthatlcontainslaldesignlthatlyoulJustlstudied.!Pleaseldolnotlguess.!!
1!

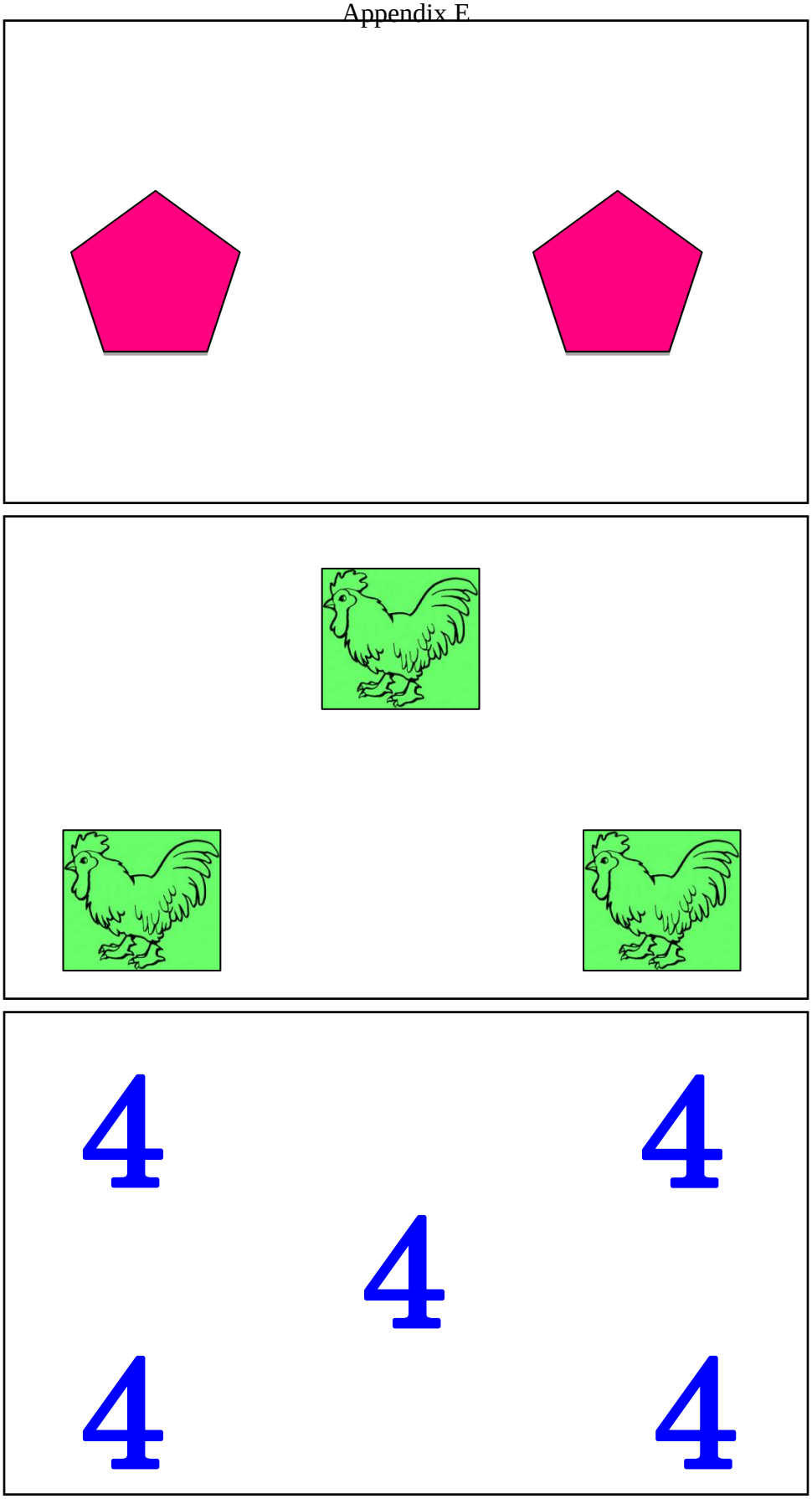
Appendix D



Please draw a circle in each box that contains a design that you just studied. Please do not guess.

2

Appendix E



Appendix F

Informed Consent Form

I, _____ (print name), understand that I will be taking part in a research project where I will organize cards, study these cards, and then take a test over what I remember without guessing. This process will occur under a total of three different conditions: 1) using the strategy the experimenter describes, 2) using the organizational strategy of my choice, and 3) just laying the cards out with no specific strategy. Lastly, I will complete a short demographic survey. I understand that I should be able to complete this project within 30 minutes. I am aware that I am free to skip any questions in the unlikely event that I feel uncomfortable answering any of the items on any of the surveys. I am also aware that my participation in this study is strictly voluntary and that I may choose to withdraw from the study at any time without any penalty. Additionally, I should not incur any penalty or prejudice because I am not physically able to complete the study. I understand that the information obtained from my responses will be analyzed only as part of aggregate data and that all identifying information will be absent from the data in order to ensure anonymity. I am also aware that my responses will be kept confidential and that data obtained from this study will only be available for research and educational purposes. I understand that any questions I may have regarding this study shall be answered by the researcher(s) involved to my satisfaction. Finally, I verify that I am at least 18 years of age and am legally able to give consent or that I am under the age of 18 but have on file with the LPP office, a completed parental consent form that allows me to give consent as a minor.

_____ Date: _____
(Signature of participant)

_____ Date: _____

(Signature of researcher obtaining consent)

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Appendix G

Feedback Letter

Thank you for participating in my study. The present study was conducted in order to investigate the effects of different organizational conditions, specifically, the effects of having someone tell you how to organize information versus making your own decision on how to organize information. This study is applicable to everyday life because understanding factors that affect how well information is stored in our minds could potentially be beneficial in school situations, especially for those who are at critical developmental stages.I hypothesized that participants would correctly recognize more cards when they were able to choose their own method for sorting and organizing the information. This study is applicable to everyday life because understanding factors that affect how well information is stored in our minds could potentially be beneficial in school situations, especially for those who are at critical developmental stages.

Please note that we are not interested in your individual results; rather, we are only interested in the overall findings based on aggregate data. No identifying information about you will be associated with any of the findings, nor will it be possible for us to trace your responses on an individual basis.

If you are interested in obtaining the final results of this study based on aggregate data, or if you have any questions or concerns regarding any portion of this study, please do not hesitate to let us know now or in the future. Our contact information is found at the bottom of this letter.

Thank you again for your valuable contribution to this study.

Sincerely,

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Appendix H

_____

Demographic Survey

1. How did you organize the cards when you were instructed to do it own your own?

2. What gender do you identify yourself as?
    a. Male
    b. Female
    c. Other

3. What is your age in years? _____