

**The Universal Image:
Are Mental Images Formed Using Prototypes?**

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This study explores the formation of mental images. Two opposing theories are reviewed concerning what influences which specific examples we choose to picture when supplied with vague concepts. The more prominent “descriptive theory” assumes that mental images are formed using the same methods of categorization and recall that other mental processes follow. Due to the descriptive theory’s similarity to the linguistic concept of prototypicality, the mental images formed by twelve participants are examined to determine whether linguistic prototypicality or our personal preferences have a higher impact in how mental images develop. A wide degree of variance in how participants perceived the concepts of “Dog,” “Bird,” “Vehicle,” and “Toy” implied that linguistic prototypicality has less of an impact on the formation of mental images when participants imagine the details of a story than when prompted to examine the same concepts outside of a story-like context. This does not support theories that linguistic prototypicality plays a part on the formation of mental images.

Imagination and mental images are neglected topics in the field of cognitive psychology and while much has been theorized, little is known about their internal processes (Shepard, 1978). Those theories that are accepted are often at conflict with one another. In the book, *The Imagery Debate* (Tye, 2000), he outlines that the crux of this conflict is that mental images can be thought of in two very different ways. Firstly, mental images can be compared to visual images. In this capacity, mental images are depictive. They occupy space on a mental canvas and can be manipulated. In the other school of thought mental images are depicted as linguistic descriptions. This theory envisions mental pictures as no more than a coalescence of our

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understanding of the many qualities that make up the concepts we envision. In a fully descriptive view of mental imagery, mental pictures are fluid and take the shape of whatever descriptors are offered. In this way, they can be simultaneously broad and specific. This allows an individual to be able to picture something that is vague but that does not break with reality and is best exemplified by the mental pictures seen while dreaming (Tye, 2000).

The pictorial or depictive view of mental images argues that images are mapped out spatially when they are created. Looking at and manipulating mental images seems to follow the same rules as physically observing or manipulating an object normally would. In one experiment, Kosslyn (1975) showed the importance of these spatial attributes. He asked participants to imagine animals of varying sizes standing next to one another. He then asked them questions about one of the animals and assessed reaction times in the answers he received. When participants were asked questions about the details of smaller animals that they had been asked to imagine as close to larger ones, it took them a longer time to respond as they had to “zoom in” to their image to check the details. Likewise, response time was significantly shorter when asked about the larger animal as no zooming was required and the image was in full view of the participants “mental canvas,” (Kosslyn, 1975). The earliest criticisms of this model were the lack of evidence that the mechanics of the brain operated in any way reminiscent of how this theory proposes them (Margolis & Laurence, 2000).

On the other hand, descriptive theories are more generally accepted due to how they allow for the vague or ambiguous qualities that mental pictures seem to often have. Daniel Dennett, a cognitive scientist and philosopher who has spent much of his career tackling the problems of the imagery debate, argues that though we may use the parts of the brain that assist in receiving pictorial data to perceive mental images, they still are internally more akin do

conceptual descriptions (as cited in Huebner, 2018). Huebner (2018) goes on to account how Dennett used the example of a tiger to best illustrate this. Dennett argued that a picture of a tiger has a distinct number of stripes. They can be counted and found to be consistent on every occasion. If one were to imagine a tiger however, they need not have a set number or pattern of stripes. The tiger would be imagined as “a large orange and black striped cat.” It is enough for a mental image to have the concept of “striped-ness” and be consistent with the linguistic description of a tiger. If one were to be asked to count the stripes they imagine, the image would calcify and move from an ambiguous concept to a concrete one seamlessly so that stripes could be counted (as cited in Huebner, 2018).

Modern theories (see for example, Gibbs, 1992) imply that imagined images of common concepts are formed through the same methods of categorization and recall that other mental processes follow. Since the beginning of the imagery debate, much has been learned about what is happening in the brain when one imagines an image. The same imagery neurons that fire when observing something are now known to be firing during mental imaging of the same thing (Kreiman, Koch, & Fried, 2000). This supports the depictive model of mental imagery. Its support of previous theories that championed imagined images as being formed through the utilization of an extensive network of cognitive processes the brain uses for other purposes seemed to rectify the two theories. Evidence that the early cortex plays a role in mental imagery further supports depictive theories (Kosslyn, 1997)

Despite advancements that support mental images as being at the very least not fully descriptive, the linguistic model remains the strongest theory due to its lower number of flaws. Images or sensations conjured in an individual’s mind’s eye are now thought to be mental manipulations of both iconic and linguistic concepts an individual is aware of and are thought to

be based in the same cognitive processes as more traditional rational thought (Byrne, 2005). In my experiment, I plan to evaluate one possible method by which mental images may be created using linguistic depictions.

Prototypicality is currently accepted as one of the primary methods of linguistic categorization. According to prototype theory, certain examples of concepts are more central to our understanding of that concept (Laurence & Margolis, 1999). As such, there are certain traits that we innately perceive as core to a concept which leads to a consistent and universal linguistic definition of a thing being held by most people. Since Rosch and Mervis (1975) first postulated the theory, prototype theory has been received as both a groundbreaking change to the manner of categorization undertaken by classical theories but also flawed in its reliance on priming and failure to explain errors caused by ignorance (Laurence & Margolis, 1999).

Prototype theory offers up the possibility that our initial perceptions of a concept are universal. It follows then that if mental images are formed through the same processes as other linguistic concepts, that how a concept is specifically imagined might be reflective of the prototypical traits of that concept but is this accurate? Are mental images of common concepts related to personal experience or preference, or are they more universal and therefore suggestive of prototypical images? I expect the results of my research to support previous theories of prototypicality and to also show that these theories can be extended to the formation of mental images. This would further support mental images as linguistic descriptions by showing that they follow the same suspected rules regarding such.

Method

Participants

Data was collected from twelve participants. Of the participants, seven were in the experimental group and five were in the control group. Participants had an average age of 18.7 and were between the ages of 18 and 24. All participants were drawn from the Lindenwood Participant Pool. Of the participants, seven identified as female and five identified as male. There were six participants that identified as Caucasian or White, four that identified as Hispanic or Latino, one that identified as Black or African American, and one that identified as Asian or Pacific Islander.

Materials and Procedures

We collected data in two separate locations on the Lindenwood campus, each with a table and two chairs. After participants signed up to volunteer for the study but prior to participating, participants were assigned a number by a random number generator. This number determined their status as either a member of the control or experimental groups. This left the possibility for uneven participant distribution among the groups but allowed for truly random samples.

Participants entered the research area and were greeted by the researcher. Two separate scripts for researchers gathering data from the control and experimental groups were used in order to create consistency in the way participants were instructed (see Appendices D and E). All participants were first offered one of two separate exempt information sheets initially explaining to participants that they would be participating in a study found to be exempt due to a low level of risk. These sheets differed in that the sheet for the control group (see Appendix A) informed participants that they would be giving examples for common concepts and the sheet for the

experimental group (see Appendix B) explained that they would be read a story while they imagined images. Both sheets reminded participants they could leave at any time.

Participants in the control group were next given the concepts of “Dog,” “Bird,” “Vehicle,” and “Toy” one at a time and asked to give what they believed was the single best example of that concept. These concepts were chosen for varying reasons. Dogs were chosen because they are the most common household pet and it was expected that participants would be highly familiar with varying breeds of dogs. Birds were chosen due to the fact that they were the primary focus of some of the earliest research into prototypicality (see Rosch and Mervis, 1975) and because it was expected that the average participant would have a lower level of familiarity with birds than with dogs. Vehicles were chosen due to them being an inanimate choice category with an extremely high level of expected familiarity. Lastly, Toys were chosen not only due to their low expectancy of familiarity but also due to the vagueness of the concept being expected to display a larger amount of variance. The researcher documented the participants answer in as much detail as possible for each of the four queries.

Participants in the experimental group were instead told to close their eyes and were primed to picture the stories they were about to be read (see Appendices D and E) in their minds. Researchers then read the stories in a clear, concise voice and at a methodical and rhythmic pace. After finishing each story, researchers asked the experimental group to describe in as much detail as they could what they imagined when prompted to picture “a dog” and “a bird” or “a vehicle” and “a toy”. The researchers documented the participants responses in as much detail as possible.

A demographic survey was given to both groups after the experiment was finished (see Appendix F). A survey meant to discern any personal connections that the participant may have had with their given answers was taken next (see Appendix G). Lastly, participants were given

prototypicality surveys listing several examples of each concept and asking them to rank these examples according to how typical the examples were of the concepts (Appendix H).

Following the surveys, participants were given a debrief form (see Appendix WE) further explaining the experiment they had participated in. Any questions participants had were answered.

Results

In the free response section, the vast majority of answers seemed to be unique and personalized. For the concept of “Dog,” the experimental group ($n = 7$) showed no similarity between answers (see Table 1). All participants imagined the dog in the scenario to be distinctly different breeds from those imagined by others in their condition. Those in the control group ($n = 5$) had at least one instance of repeat response. The breed “Golden Retriever” was chosen by three of the five participants to be the breed most representative of the concept of “Dog.” The concept of “Bird” seemed to provide slightly more consistency. Of the twelve participants, there was one repeat response that was shared between control and experimental groups. “Cardinal” was recorded as both the best representative of the concept by two individuals and was imagined by a single participant. Three other answers were repeated among the experimental group; “Pigeon,” “Blue Jay,” and “Black Bird” were imagined twice. For the category of “Vehicle,” the most common response was by far “Car.” “Car” represented all but one of the answers in the control level and a third of answers in the experimental group as well. Responses for “Toy” featured only one repeat response in the experimental category; “Robot Toy.”

The connections to concept survey revealed that 58.3% of results in the control group were reported to have personal significance to participants (Appendix J). In the experimental group, 75% of results were reported to have personal significance. Data from both groups

showed that 77.7% of participants had connections to their answers for the categories of “Dog,” “Vehicle,” and “Toy.” The exception to this consistency was the category of “Bird in which only 44% reported connections to their answers.

Prototypicality weights were calculated from the results of the prototypicality survey ranging from 1 at the most prototypical to 12 at the least. In the category of “Dog,” “Golden Retriever” was found to be the most prototypical example of “Dog” with an average prototypicality score of 2.22 ($SD = 1.31$) (Table 2). For the category of “Bird,” “Pigeon” was the most prototypical option among those on the survey (see Table 1) with an average prototypicality score of 4.55 ($SD = 2.62$). In the category of “Vehicle,” by far the most prototypical answer was “Car” with a prototypicality score of 1.33 ($SD = 0.66$) (Appendix K). Lastly, for the concept of “Toy,” the most prototypical answer was “Blocks” with a prototypicality score of 4.33 ($SD = 2.31$).

Discussion

Several conclusions can be drawn from the data. A high degree of variance (26 different answers) in experimental group implies a less unified process for the formation of mental images than would be expected if linguistic prototypes were affecting the image formation in the context of a self-directed story. Lower variance (15 different answers) in control group coupled with a more consistent clustering of answers with strong levels of prototypicality are consistent with answers being more prototypical outside of a story-like context. The control group had 3 repeated answers in “golden retriever” at 3, “car” at 4, and a single repeat of “cardinal.” Overall, it seemed participants in the control group were 24% more likely to respond with answers that had a high prototypicality weight (between 5.0 and 1.0).

Interestingly, there were instances where participants could not name what it was that they had pictured but rather were able to describe qualities of what they had seen. This implies weakly that they had more of an idea than an image in their mind's eyes. The low rate at which this occurred however makes any conclusions drawn from it inconclusive.

With regards to prototypicality results, lower means of the most prominent results in the categories of "Dog" and "Vehicle" compared to those found in "Bird" and "Toy" seem to imply that certain concepts are easier for participants to agree on than others. Dogs are considered common pets and it is likely that having a high rate of exposure to them lead to participants being more familiar with specific breeds and their variance or lack thereof from prototypical traits of the concept of "Dog." Furthermore, transportation via an array of vehicles is a reality in today's world leading to even non-drivers being familiar with more common examples of "vehicles" and associating what traits are relevant to the category. As cars are by far the most predominant vehicle used for everyday transportation, the open-ended nature of the wording in the stories led to participants picturing them even though no leading information was presented that would prompt such. Likewise, "cardinal" being the most common answer in "Bird" across both conditions was heavily implied via the connections to concepts survey to be due to the fact that participants were drawn from the St. Louis area, home of the St. Louis Cardinals baseball team.

Of the open-ended responses across both categories, only 25% of answers occurred more than once. When coupled with the relatively high rate of connections to concepts, this implies that more subjective options are chosen when creating open-ended mental images. Apart from the category of "Toy," in each of the categories, the most common free response answer was both on the prototypicality survey and the option with the highest average prototypicality weight

in its respective category. In the case of “Bird,” this was especially true with both “Cardinal” and “Pigeon” tying for the heaviest prototypicality weight and only being ranked by their respective standard deviations. Participants’ tendency to imagine examples with a high level of personal connection then seems to give more support to depictive theories.

That participants seemed to have a high rate of connecting to their answers is however not completely disqualifying of prototypicality. This is suggested by Rosch’s work (see for example, Rosch & Mavis, 1975) in the field as she determined that prototypicality was most likely localized and would vary based on what was common and in proximity. That is to say, certain traits might be universally prototypical but what examples embody these traits best is dependent on one’s familiarity with the concepts in question and their exposure to various possible examples of such concepts. Because of this, my results may be more indicative of the melting pot nature of the college population than of a break from the “universal image.”

Because of this, I believe that rather than stating individuals imagine either something meaningful to them or something prototypical, individuals imagine the most meaningful concept with a high level of assumed prototypicality. This is to say that an individual who often travels by bike might imagine a van rather than a bicycle or a car if someone with a level of familiarity to them travels by van because the concept would be more personal than the most prototypical answer and yet more prototypical than their most familiar mode of transportation. I believe this specific angle is worth further research.

This project was envisioned with free response being a key component of assessing mental images, but that key component ultimately created the most roadblocks for obtaining data that could be statistically tested. I had expected the vast majority of answers in the free response section to be overlapped with those examples provided to participants in order to determine

prototypicality. Instead, what I immediately was faced with was the reality that there seemed to be very little unification in what was imagined and that more than half of free response answers were not addressed on the prototypicality survey. This made it difficult to run statistical analyses on two of the study's primary focuses; those images that were pictured by those in the experimental group and those examples of concepts expressed by the control. Furthermore, I did not include a back-up manner of attaining prototypicality weights of free response answers not on the prototypicality survey.

Overall, I would like to continue this experiment in the future with slight modifications in protocol. Upon reflecting on my design, I feel there are many ways it can be improved upon to provide more specific data. Firstly, I would like to broaden lists of options for attaining prototypicality results. For instance, a list of 25 to 50 breeds of dog might be required in order to encompass the majority if not all encountered free response answers in that category. In this way I would be able to compare the average prototypicality scores of answers from the two groups of participants.

The second change I would make is in the manner I would calculate prototypicality weights. In a study performed by Uyeda & Mandler (1980), participants were given individual examples of concepts and asked to rank those examples on a scale of one to seven with regards to how prototypical they believed that example was of the given concept. This is different than the method used by Rosch and Mervis (1975) that I replicated in that it does not test relative prototypicality of similar examples and allows for a greater number of examples to be ranked without concern for comparison.

Lastly, I would like to expand the scope of the experiment in the future to explore both prototypicality and mental imagery on the subjects of race and gender assumptions. As the basis

for the original inspiration for this study, I feel that with the improvements I have already mentioned to the design, such would be worth exploring at length and could be received with an acceptable level of success.

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Table 1
Count of Free Response Answers

	Control	Experimental
Dog	Golden Retriever: 3, Corgi: 1, Basset Hound: 1	Beagle: 2, Border Collie: 1, Bulldog: 1, German Shepard: 1, Lab: 1, Shiatzu: 1
Bird	Cardinal: 2, Parrot: 1, Canary: 1, N/A: 1	Black Bird: 2, Pigeon: 2, Blue Jay: 2, Cardinal: 1
Vehicle	Car: 4, Mini Van: 1	Car: 2, Bus: 1, Double Decker Bus: 1, Mini Van: 1, SUV: 1, Truck: 1
Toy	Doll: 1, Action Figure: 1, Ball: 1, Toy Car: 1, Toy Drums: 1	Robot Toy: 2, Nintendo DS: 1, Toy Truck: 1, Stackable Rings on a Stick: 1, Wooden Figures: 1, N/A: 1

Table 2

Average Prototypicality Scores (1.0-12.0)

	Mean Prototypicality	Standard Deviation
Labrador Retriever	6.88	2.6
Poodle	3.55	2.83
German Shepard	2.22	1.31
Golden Retriever	8.88	2.84
Chihuahua	8.22	2.82
Pug	6.33	2.27
Siberian Husky	7.44	1.95
Great Dane	9.22	1.93
Cocker Spaniel	8.11	3.18
Dachshund	7.66	2.36
Beagle	7.22	3.55
Rottweiler	5.22	3.76
Crow	6.77	2.57
Robin	10.88	1.85
Kiwi	10.00	2.71
Ostrich	5.00	3.77
Bald Eagle	5.77	2.25
Falcon	5.22	1.99
Parrot	6.22	3.26
Cardinal	4.55	2.91
Toucan	6.22	3.52
Pigeon	4.55	2.62
Sea Gull	6.44	2.87
Car	1.33	0.66
Jeep	3.66	3.02
Van	3.66	1.49
Motorcycle	5.77	2.25
Bicycle	9.33	3.42
Jeep	5.22	2.90
Bus	4.33	1.66
Airplane	8.11	2.60
Moped	8.77	2.17
Boat	9.33	1.73
Train	7.88	1.61
Tractor	9.77	2.22

Blocks	4.33	2.31
Puzzle	6.55	2.65
Legos	4.33	2.83
Toy Car	4.33	2.58
Toy Train	6.44	3.17
Action Figure	5.88	2.15
Doll House	7.77	3.27
Ball	4.55	3.57
Stuffed Animal	6.55	3.32
Top	10.00	1.41
Doll	6.33	4.06
Tablet	9.90	2.42

Blocks	4.33	2.31
Puzzle	6.55	2.65
Legos	4.33	2.83
Toy Car	4.33	2.58
Toy Train	6.44	3.17
Action Figure	5.88	2.15
Doll House	7.77	3.27
Ball	4.55	3.57
Stuffed Animal	6.55	3.32
Top	10.00	1.41
Doll	6.33	4.06
Tablet	9.90	2.42

Appendix A
Control Script
Procedure

- Greet participants and have them sign our sign-in sheet.
- Give participants Exempt Information Sheets. Let them read. As they are reading, briefly go over what they will be doing. “Thank you for participating in our Research Study. In this study we are evaluating if Mental Images are formed in a similar manner to Linguistic Prototypes. What this means for you is that I will be asking you what you believe is the best example for a number of concepts. It is your choice if you participate in this study. You may choose not to participate at any time.” After you have spoken to the participant and the participant signs the sheet, collect it and continue to the next step. If they do not sign and decide not to participate, the procedure ends here.
- “Thank you. Let’s begin. What do you think is the best example of a “Dog?” If asked for clarification, state that we would like to know the specific breed that best represents the concept of “Dog”. If they are unsure, you may ask non guiding questions to help the participants (ie. “Was it a big dog or a small dog? What color was it? Did it have a long snout or a flat one? Was it’s a long hair or a short hair?”) Try not to ask specific questions like “was it a golden retriever?” unless participants state that they can clearly picture what they saw but don’t know what to call it. Record the answer on your data sheet.
- “What do you think is the best example of a “Bird?” Again, we are looking for a specific kind of bird (such as a crow, falcon, pigeon, owl, etc.) If they are unsure, you may ask non guiding questions to help the participants. Record the answer on the Data Sheet.
- “What do you think the best example of a “Vehicle” is?” We are looking for a specific kind of vehicle (such as a car, train, bus, airplane, etc.) We are not looking for brand of vehicle (Toyota, Ford,

Boeing, etc). If they are unsure, you may ask non guiding questions to help the participants.

Record the answer on the Data Sheet.

- “What do you think the best example of a “Toy” is?” We are looking for a specific kind of toy. If they are unsure, you may ask non guiding questions to help the participants. Record the answer on the Data Sheet.
- Give the participant our demographic survey and ask them to fill it out. Retrieve it when finished.
- Give the participant our “Connections to Concepts survey and ask them to fill it out. Feel free to answer any questions the participants may have about the meaning of this survey. Remember, this survey is meant to determine if any of the answers the participants pictured had any personal significance to them. Perhaps they used to build model trains; this would have been relevant to the fact that they pictured a train for “Vehicle”. Perhaps they are a sports fan and saw a Cardinal for “Bird”. Perhaps they really like Poodles and pictured a Poodle for “Dog”. Retrieve it when finished.
- Give the participant our “Prototypicality survey”. Explain to them that this survey is not related to what they pictured but rather that it will be used to determine what good examples of the given concepts are. “Please order the following examples according to how well they represent the concepts. The example you select as 1 should be most representative of the concepts. The example you select as 12 should be least representative of the concepts. Retrieve it when finished.
- Give participants the “Debrief Letter” and ask them if they have any questions about our study. Try to answer any questions they may have. When they no longer have any, thank them for their participation and the procedure ends.

Appendix B
Experimental Script
Procedure

- Greet participants and have them sign our sign-in sheet.
- Give participants Exempt Information Sheets. Let them read. As they are reading, briefly go over what they will be doing. “Thank you for participating in our Research Study. In this study we are evaluating if Mental Images are formed in a similar manner to Linguistic Prototypes. What this means for you is that I will be reading you a story while you close your eyes and imagine the events I describe to you. I will then ask you questions about how you imagined the stories you were read. It is your choice if you participate in this study. You may choose not to participate at any time.” After you have spoken to the participant and the participant signs the sheet, collect it and continue to the next step. If they do not sign and decide not to participate, the procedure ends here.
- “Thank you. I will now read you the first story. While I read it, please close your eyes and try to picture the events you hear inside your mind.” Read the following at a slow but natural pace, pausing to give participant’s time to picture the events. Be sure to read clearly. Try to develop a speaking pattern with it that you will use with all participants.

“Jackie was walking the dog when they came upon a bird standing on the ground. Excited, Jackie’s dog ran up to the bird and startled it. The bird quickly took off and almost ran into Jackie’s face as it passed. Jackie smiled at the dog and the two watched as the bird disappeared into the distance.”
- “You may now open your eyes.” Ask the participant, “Now, when you pictured that scene, what type of dog did you picture?” If asked for clarification, state that we would like to know the specific breed they imagined. If they are unsure, you may ask non guiding questions to help the participants (ie. “Was it a big dog or a small dog? What color was it? Did it have a long snout or a flat one? Was it’s a long hair or a short hair?”) Try not to ask specific questions like “was it a

golden retriever?” unless participants state that they can clearly picture what they saw but don’t know what to call it. Record the answer on your data sheet.

- “What about the bird? What type of bird did you picture?” Again, we are looking for a specific kind of bird (such as a crow, falcon, pigeon, owl, etc.) If participants have trouble identifying the type of bird that they saw, you may again ask non-guiding questions to help them determine the bird they pictured. Record the answer on the Data Sheet.
- “I will now read you the second story. Again, as I read it to you, please close your eyes and try to picture events you hear inside your mind.” Again, read the following clearly at a slow, natural pace.

“Alex would rather have been at home. It was rainy, and the ride thus far had been rather choppy. The vehicle would safely deliver Alex to the destination, but it would be much more relaxing to be at home watching over the twins. They would be sitting on the floor just about now, engrossed in their favorite toy. Alex could picture them smiling as they played with it. The thought of them playing brought a smile to Alex’s face.”

- “You may now open your eyes.” Ask the participant, “Now, when you pictured that scene, what type of vehicle did you picture Alex inside of?” We are looking for a specific kind of vehicle (such as a car, train, bus, airplane, etc.) We are not looking for brand of vehicle (Toyota, Ford, Boeing, etc). I do not expect any participant to not be able to identify what type of vehicle they pictured but if this happens, use the same non-leading questions you have used up until now. Record the answer on the Data Sheet.
- “What about the toy? What type of toy did you picture the children playing with?” We are looking for a specific kind of toy the participant pictured. The concept of “toy” is rather vague and can be applied to almost anything found enjoyable. Accept any answer given. If participants have trouble identifying what they pictured, you may again ask non-guiding questions to help them determine it. Record the answer on the Data Sheet.
- Give the participant our demographic survey and ask them to fill it out. Retrieve it when finished.

- Give the participant our “Connections to Concepts survey and ask them to fill it out. Feel free to answer any questions the participants may have about the meaning of this survey. Remember, this survey is meant to determine if any of the answers the participants pictured had any personal significance to them. Perhaps they used to build model trains; this would have been relevant to the fact that they pictured a train for “Vehicle”. Perhaps they are a sports fan and saw a Cardinal for “Bird”. Perhaps they really like Poodles and pictured a Poodle for “Dog”. Retrieve it when finished.
- Give the participant our “Prototypicality survey”. Explain to them that this survey is not related to what they pictured but rather that it will be used to determine what good examples of the given concepts are. “Please order the following examples according to how well they represent the concepts. The example you select as 1 should be most representative of the concepts. The example you select as 12 should be least representative of the concepts. Retrieve it when finished.
- Give participants the “Debrief Letter” and ask them if they have any questions about our study. Try to answer any questions they may have. When they no longer have any, thank them for their participation and the procedure ends.

Appendix C

Exempt Information Sheet Control

LINDENWOOD**Research Information Sheet**

You are being asked to participate in a research study. We are doing this study to explore whether mental images are formed in a manner that aligns with theories of prototypicality. During this study you will be given a number of concepts and be prompted to give the best example for such a concept. Afterwards, you will be asked to fill out three short surveys. It will take about 10 to 15 minutes to complete this study.

Your participation is voluntary. You may choose not to participate or withdraw at any time.

There are no risks from participating in this project. There are no direct benefits for you participating in this study.

We will not collect any data which may identify you.

If you are in the LPP you will receive two extra credit points in the course for which you signed up for the LPP. You will receive extra credit simply for completing this information sheet. You are free to withdraw your participation at any time without penalty. Participants who are not part of the LPP will receive no compensation beyond the possible benefits listed above. However, your participation is an opportunity to contribute to psychological science.

We will do everything we can to protect your privacy. We do not intend to include information that could identify you in any publication or presentation. Any information we collect will be stored by the researcher in a secure location. The only people who will be able to see your data are: members of the research team, qualified staff of Lindenwood University, representatives of state or federal agencies.

Who can I contact with questions?

If you have concerns or complaints about this project, please use the following contact information:

Adam Martz at Gam754@Lindenwood.edu

Megan Hamilton at Mth728@Lindenwood.edu

Nam Nguyen at Ndn585@Lindenwood.edu

Michiko Nohara-LeClair at Mnohara-leclair@Lindenwood.edu

If you have questions about your rights as a participant or concerns about the project and wish to talk to someone outside the research team, you can contact Michael Leary (Director - Institutional Review Board) at 636-949-4730 or mleary@lindenwood.edu

Appendix D

Exempt Information Form Experimental

LINDENWOOD**Research Information Sheet**

You are being asked to participate in a research study. We are doing this study to explore whether mental images are formed in a manner that aligns with theories of prototypicality. During this study you will be asked to close your eyes and imagine the events in a story being read to you. You will then be asked to describe the mental images you pictured. Afterwards, you will be asked to fill out three short surveys. It will take about 10 to 15 minutes to complete this study.

Your participation is voluntary. You may choose not to participate or withdraw at any time.

There are no risks from participating in this project. There are no direct benefits for you participating in this study.

We will not collect any data which may identify you.

If you are in the LPP you will receive two extra credit points in the course for which you signed up for the LPP. You will receive extra credit simply for completing this information sheet. You are free to withdraw your participation at any time without penalty. Participants who are not part of the LPP will receive no compensation beyond the possible benefits listed above. However, your participation is an opportunity to contribute to psychological science.

We will do everything we can to protect your privacy. We do not intend to include information that could identify you in any publication or presentation. Any information we collect will be stored by the researcher in a secure location. The only people who will be able to see your data are: members of the research team, qualified staff of Lindenwood University, representatives of state or federal agencies.

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Appendix E

Demographic Survey

Demographic Survey

1. What is your age?

2. What is your Gender?

A. Male

B. Female

C. Other (please specify):

D. Prefer not to say

3. What is your Ethnicity? Select all that apply.

A. White or Caucasian

B. Hispanic or Latino

C. Black or African American

D. Native American or American Indian

E. Asian or Pacific Islander

F. Other (please specify):

Appendix F

Connections to Concepts Survey

Connections to Concepts Survey

1) Have you ever owned a dog of the breed that you listed for the purposes of this study or otherwise had an experience that would make that breed meaningful to you in some way?

2) Have you ever owned a bird of the type that you listed for the purposes of this study or otherwise had an experience that would make that type of bird meaningful to you in some way?

3) Have you ever owned a vehicle of the type that you listed for the purposes of this study or otherwise had an experience that would make that type of vehicle meaningful to you in some way?

4) Have you ever owned a toy of the type that you listed for the purposes of this study or otherwise had an experience that would make that kind of toy meaningful to you in some way?

Appendix G

Prototypicality Survey

Prototypicality Survey

1) Please order the following examples according to how well they represent the concept of “Dog”. The example you select as (1) should be most representative of the concept of “Dog”. The example you select as (12) should be least representative of the concept of “Dog”. If you are unfamiliar with one or more of the options, please inform the researcher and an image will be shown.

Labrador Retriever

Poodle

German Shepherd

Golden Retriever

Chihuahua

Pug

Siberian Husky

Great Dane

Cocker Spaniel

Dachshund

Beagle

Rottweiler

2) Please order the following examples according to how well they represent the concept of "Bird". The example you select as (1) should be most representative of the concept of "Bird". The example you select as (12) should be least representative of the concept of "Bird". If you are unfamiliar with one or more of the options, please inform the researcher and an image will be shown.

Crow

Robin

Kiwi

Ostrich

Owl

Bald Eagle

Falcon

Parrot

Cardinal

Toucan

Pigeon

Sea Gull

3) Please order the following examples according to how well they represent the concept of "Vehicle".

The example you select as (1) should be most representative of the concept of "Vehicle". The example you select as (12) should be least representative of the concept of "Vehicle". If you are unfamiliar with one or more of the options, please inform the researcher and an image will be shown.

__ Car

__ Jeep

__ Van

__ Motorcycle

__ Bicycle

__ Truck

__ Bus

__ Airplane

__ Moped

__ Boat

__ Train

__ Tractor

4) Please order the following examples according to how well they represent the concept of "Toy". The example you select as (1) should be most representative of the concept of "Toy". The example you select as (12) should be least representative of the concept of "Toy". If you are unfamiliar with one or more of the options, please inform the researcher and an image will be shown.

Blocks

Puzzle

Legos

Toy Car

Toy Train

Action Figure

Doll House

Ball

Stuffed Animal

Top

Doll

Tablet