Running head: SEX AND SPATIAL LOCATION MEMORY

The Effect of Sex of Parent and Sex of Pup on

Spatial Location Memory in Spiny Mice

Angelina Dye

Rider University

Abstract

The present study examined the effect of sex (of parent and pup) on memory for spatial location memory for kin of spiny mice. A total of 16 mice (6 families) were tested. Sex of pup (<u>son</u> and <u>daughter</u>) and sex of parent (<u>father</u> and <u>mother</u>) served as independent variables. The amount of time spent in the companion zone on test day (to the nearest .01 s) and the count of visits to the companion zone were recorded. After isolation, the chooser was placed into a maze with either father or mother as a stimulus for learning. On test day, the chooser was placed into the maze without the stimulus to measure if remembering occurred. the sons remembered the precious location of their parents more than the daughters, and the fathers previous locations were remembered more than the mothers; however, the findings were not statistically significant.

The Effect of Sex of Parent and Sex of Pup on

Spatial Location Memory in Spiny Mice

According to Halpin (1991), kin recognition is the ability of animals to distinguish between kin and non-kin by using conspecific cues. Recognition can be spatially-based, since animals in close proximity tend to be related. Strangers within this location are treated as kin. Because of this, Halpin believed that animals that use spatial cues exclusively are incapable of distinguishing between kin and non-kin.

Recognition can also be through association, but is also closely related to spatially based recognition. In this case, the animals have a period of association in which those who are initially non-kin will be regarded as kin; however, those who are non-kin who are not present during the association period will still be regarded as non-kin. Without having learned the conspecific cues during the association period, even kin related animals will be regarded as non-kin. This is the most common means of recognition.

Through previous association, animals individual cues may either be genetically or environmentally determined. The recognition cue is a signature trait of the individual. Group cues are are also used for recognition, which either consist of a common group label or the combination of the individuals in the group. Most likely, group cues are the result of a combination of the individually characteristic cues of the individual members, are environmentally determined, and may result in phenotype matching for recognition.

Phenotype matching is also used for kin recognition. In this, the animal who is kin but is absent during the period of association, is still regarded as kin. Even kin with no previous encounters are still recognized by the common phenotypic trait. This type of recognition, which is primarily genetically determined, can result from environment, but is rare.

In a study conducted by Terranova, Loggi, Chiarotti, and Laviola (2000), the effects of sibling social conditions (PSS) conditions and precocious weaning on the social preferences of adult mice. Sex, PSS, and weaning condition (regular and precocious) served as the independent variables. The first goal box entered was recorded, as well as the amount of time spent in each goal box (to the nearest .01 s). For each trial, the two stimulus mice were given a 5-min period in the apparatus for familiarization. The experimental mouse was then placed in a start box for 15 s and then admitted into the apparatus, for 3-min trials with 15 s intertrial intervals. The entire test session lasted 13 min and consisted of four trials. The PSS effects for modulating siblings were not significantly affected by the presence or the absence of the mother. PSS and weaning condition did not have a significant effect on each other. Therefore, the authors noted that the direct influence of litter mates' characteristics in early ontogeny primarily resulted from the PSS related sibling effects on adult behavior.

The current study examined two independent variables, the sex of the chooser (son and daughter) and the sex of the parent (father and

mother). The dependent variables were the amount of time (to the nearest .01 s) spent in companion zone and the count of visits to the companion zone. The between-subjects factor was the sex of the chooser, and the within-subjects factor was the sex of the parent. The pups should have a better memory for their mothers than their fathers.

Method

Animals

There were six families of Egyptian spiny mice (Acomys cahirinus) used, which consisted of eight sons and eight daughters total. The pups were 10 to 25 days old. There was one family per cage. The home cage used was a plastic unit (10W X 19D X 6H in.) with a wire bar lid. Purina 5012 rat chow and water were readily available, and Alpha dri bedding was used in the cages. The light cycle, regulated by an automatic timer, was from 6AM to 6PM. The temperature was also kept consistent at 74-75F.

Materials

An isolation cage, identical to the home cage, was used for each pup in the study. These were located in the same room but on a separate shelf from than the home cage. Beakers and pitchers were used to move and transport mice from home cage to isolation cage as well as from isolation cage to maze. Mason jars and wire lids for jars were used to contain the stimulus animal for use in the maze. The purpose of the handling equipment was to minimize human interaction.

The maze used was a habit test unit (Coulbourne Instruments). There were four arms (North, South, East, and West) on the X-shaped maze, with the hub being the center of the maze. Brackets were on the end of each of the arms to hold the mason jars. Photocells were mounted in each arm to detect animal movements.
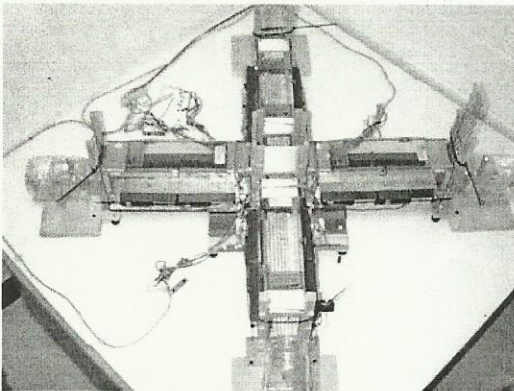
The signals from the photocells were monitored by a computer. The computer recorded the amount of time that the chooser spent in each arm and counted the number of movements that the chooser made between arms for a 20 min period.

Design and Procedure

There was a two-day series, day one for learning and day two for testing. Preparations for day one included a 12 to 15 hr time lapse

for isolation. Learning sessions began at approximately 1000 hrs. A chooser animal and a stimulus animal was obtained from the isolation cages. The computer was programmed for recording. The stimulus animal was placed in a mason jar, which was covered with a wire lid. The mason jar was then placed in one of the selected brackets. The chooser animal was transported to the maze in a beaker and pitcher and placed in the middle of the maze. The door was then shut to the testing room where the maze was located for the 20-min period. After, the chooser and the stimulus were separately retrieved from the maze and placed back in the isolation cages. After all of the family was tested, there was a reunion in the home cage for 5 hrs, followed by isolation. For day two, the same process was conducted for the chooser, but there was no stimulus animal. All four mason jars on the arms of the maze were empty for the 20-min testing period. Once the family was tested, there was a permanent reunion.

Results

There were two dependent variable, the count of visits by the chooser to the companion zone and the amount of time spent in the companion zone (nearest 0.01s). The companion zone was the area of the maze that contained the parent. The range of raw scores for the learning and testing trials were 8.25 to 375.10 and 0.32 to 135.52 for the father, and 15.33 to 935.43 and 0.00 to 102.32 for the mother. The duration score had a higher variability with the mother than the father.

Proximity Score On Test Day

The analysis of variance was mixed with the sex of the pup as the between subjects variable and the sex of the parent as the within subjects variable. The sons remembered the previous location of their parents more than the daughters, but the difference was not significant, $F(1,14) = 0.089$, $p > .05$. The previous locations of the fathers were remembered more than the mothers, but the difference was not significant, $F(1, 14) = 1.584$, $p > .05$.

Discussion

If the pup spent the most time in the arm that the parent was in, then the pup should have remembered the previous location of the parent, according to the hypothesis. Even though the findings were not significant, the father's previous location was better remembered than the mother's location, and the sons remembered the previous location of their parent better than the daughters. This was because the data showed examples of both avoidance and and preference for the previous location of the parent. For example, while some pups showed a preference for the mother but avoidance of the father, other pups showed a preference for the father but avoidance of the mother. One son spent 95.68 s in the previous location of the father, and one son spent 102.32 s with the mother.

According to Porter (1988), pups that suckle from a lactating mother are labeled with the mother's chemical secretions, which are used for identification of offspring. In his own experiment, Porter paired off siblings from different families into pairs, and after 10 days, he observed four of the unrelated spiny mice in a terrarium.

Because they were housed with the strange mouse's siblings, the mice displayed diadic huddling with the sibling of their cage mate. Porter found that those with sibling familiarity were observed significantly more than those with no sibling familiarity. Like the present study, another one of Porter's experiments also isolated the mice. Porter individually isolated the mice for 8 days, and yet, they showed no recognition during reunion. Porter then isolated the mice for 9 days with a sibling, and they showed recognition during reunion. The present study isolated the mice for only 12-15 hours (compared to 8-9 days), which may account for inconclusive data.

References

Halpin, Z. T. (1991). Kin recognition cues of vertebrates. In P. Hepper (Ed.), <u>Kin recognition</u> (pp. 220-258). Cambridge: Cambridge University Press.

Porter, R. H. (1988). The ontogeny of sibling recognition in rodents: Superfamily muroidea. <u>Behavior Genetics, 18(4)</u>, 483-494.

Taranova, M. L., & Loggi, G. & Chiarotti, F. & Laviola, G. (2000). Attractivity and social preferences in mice (Mus musculus domesticus): The role of prepubertal sexual segregation and of precocious weaning. <u>Journal of Comparative Psychology, 114(4)</u>, 325-334.

Table 1

Proximity Score on Test Day as a Function of Sex of Pup and Sex of Parent.

Group	Mean	Standard Deviation
Sex of Pups		
Son	41.42	32.98
Daughter	37.84	35.95
Sex of Parent		
Father	47.39	38.43
Mother	31.86	27.96

ANOVA Table for Sex of Parent

	DF	Sum of Squares	Mean Square	F-Value	P-Value	Lambda	Power
Pup Sex	1	102.495	102.495	.089	.7694	.089	.059
Subject(Group)	14	16063.842	1147.417				
Sex of Parent	1	1928.360	1928.360	1.584	.2287	1.584	.206
Sex of Parent * Pup Sex	1	672.620	672.620	.553	.4695	.553	.104
Sex of Parent * Subject(Group)	14	17040.105	1217.150				

Descriptive Statistics
Split By: Pup Sex

	Mean	Std. Dev.	Std. Error	Count	Minimum	Maximum	# Missing
Sex of Parent, Total	39.627	33.986	6.008	32	0.000	135.520	0
Sex of Parent, Son	41.417	32.984	8.246	16	0.000	102.320	0
Sex of Parent, Daughter	37.837	35.950	8.987	16	3.620	135.520	0

The sons remembered the previous location of their parents more than the daughters, but the difference was not significant, $F(1,14) = 0.089$, $p > .05$.

Descriptive Statistics
Split By: Sex of Parent

	Mean	Std. Dev.	Std. Error	Count	Minimum	Maximum	# Missing
Sex of Parent, Total	39.627	33.986	6.008	32	0.000	135.520	0
Sex of Parent, Father	47.390	38.427	9.607	16	.320	135.520	0
Sex of Parent, Mother	31.864	27.964	6.991	16	0.000	102.320	0

The fathers previous locations were remembered more than the mothers, but the difference was not significant, $F(1, 14) = 1.584$, $p > .05$.