

Introduction

One of the most robust memory functions in humans is the serial position effect. This effect is defined as the tendency for items at the beginning and end of a list to be recalled better than items in the middle (Davis & Palladino, 2003). Recalling items from the beginning of the list is known as the primacy effect and recalling items from the end of the list is known as the recency effect.

The serial position effect, the primacy effect, and the recency effect have been well researched in humans through a procedure called serial probe recognition (*On human memory*, 1999). In this procedure the subject is given a list of items, presented one at a time. After the list is complete, probe items are presented. If the probe item presented is one of the items from the list, then the subject is instructed to say that item is familiar or “from the list”. If the item was not on the list, the subject is instructed to say that the item is unfamiliar or “not on the list”. Once the probes have been presented, the researcher graphs the likelihood of correct identification according to position in the list, generating a curvilinear function. For a human, the serial position curve is generally “U” or “J” shaped. If it is “U” shaped, then the primacy and recency effect are equal in strength, but if it is “J” shaped then the primacy effect is not as strong as the recency effect.

While a researcher can simply ask a human to indicate whether a probe is “from the list” or not, this is not possible with nonhumans. So, two different testing procedures have been developed: these are called same/different and non-match to sample. In the same/different procedure, an animal is trained to make one response to familiar (same) items and a different response to unfamiliar (different) items. A list of items is presented to the animal one at a time and then the same/different procedure is used as probe items are presented. Using the other

procedure, non-match to sample, the animal is trained to consistently choose an unfamiliar item when presented with a comparison probe of both a familiar and unfamiliar item.

One of the first convincing animal models of the serial position effect was done by Sands and Wright (1980) using the same/different procedure with both a human and a rhesus monkey. Sands and Wright presented ten item lists of pictures (one at a time) to both the monkey and the human, then tested the subjects with probe items. The serial position curves of both the monkey and the human were similar, with a stronger recency than primacy effect (J curves). Sands and Wright controlled for several variables that had not been well controlled in previous research on monkeys, and learned that size of the pool of items and length of the list was critical. Other nonhuman primates such as squirrel monkeys and chimpanzees have shown the serial position effect with visual items (Castro 1997; Castro & Larsen, 1992; Wright, Santiago & Sands, 1984). Dolphins also show the serial position effect when tested with auditory cues (Thompson & Herman, 1977).

Experiments testing the serial position effect have been done in rats but results of these studies are ambiguous: some researchers have found a serial position effect (Reed, Chih-Ta, Aggleton & Rawlins, 1991); others find only a recency effect (Deacon, & Rawlins, 1995); and some have found no evidence for a serial position effect (Ellis, Clegg, & Kesner, 1984). It should be noted that these studies used textural and visual stimuli to test for the effect. However, recent research indicates olfactory stimuli are better choices for rats (Pena, Pitts & Galizio, 2006) because they capitalize on the olfactory acuity of rats.

Specific Objective/Research Question

The purpose of my study is to test for a serial position effect in rats (*Rattus norvegicus*) using olfactory stimuli. For this study, a modified operant chamber and a list learning non-match

to sample procedure will be used. The hypothesis for this study is that the rats will show a J shaped curve when tested for the serial position effect. Also, as the list length lengthens, the curve will become more prominent.

Justification/Rationale

This study will add to our knowledge about memory capabilities across species. In addition, it is useful to develop reliable animal models of memory that can be used for behavioral pharmacology studies that test for effects of drugs and aging on memory.

Methods

Subjects

At least eight male Sprague-Dawley rats will be used for this study. They will be housed in the Psychology Animal Lab on a 12-hour reversed light/dark cycle with water freely available. Rats will be maintained at about 85% of free-feeding weight to ensure that they will respond for sugar pellet reinforcement. Rats will be approximately 90 days old at the beginning of the study. All housing and testing procedures have been approved by the Institutional Animal Care and Use Committee.

Apparatus

The apparatus (Fig. 1) is a modified operant chamber, measuring 28-cm long x 26-cm wide x 30-cm high. The walls are made of Plexiglas with a 4-cm section removed from the bottom of the front wall so that a plastic tray can be inserted into the chamber. There are two different trays used for this procedure. The sample tray has a 5-cm hole drilled into the top of the tray, approximately 3cm from the front of the tray and 10cm from the sides. The comparison tray contains two holes, identical in size to that of the sample tray, drilled adjacent to each other and approximately 8cm apart. Four screws, forming a square, were drilled around the edges of the

hole. These screws are in place to loosely hold the stimulus lids over the cup. The screws allow the lids to slide back and forth when pushed. The cups are 2oz condiment cups filled to a depth of 2cm with sand. The stimulus lids are Plexiglas (3X3 in) and may be scented with household spices. Lids are kept in a container with spice when not in use.

Pretraining Phase 1

In the first phase the rat will be habituated to the chamber, then trained to dig for sugar pellets in a cup of sand located in a cup on the sample tray. After he reliably digs for sugar pellets, the rat will be trained to push a Plexiglas lid that covers the cup. After the rat reliably pushes the lid, scented lids will be introduced.

Pretraining Phase 2

A total of thirty different scented lids will be used for the study. The lids will be inserted into the chamber on the sample tray and the rat will be reinforced with a sugar pellet for pushing the lid back and digging in the sand in the cup. After the rat reliably pushes the lid back to receive the pellet, non-match to sample (NMTS) training will begin. Each session will consist of thirty trials. The sample tray will be inserted with a scented lid (ex: paprika). The rat will push the lid back so the cup of sand is revealed and dig for the buried pellet for reinforcement. The sample tray will be removed and the comparison tray will be immediately inserted into the chamber with the original scent and a novel scent (ex: paprika and cumin). The rat will be reinforced with a sugar pellet only when he pushes the novel/unfamiliar scented lid (ex: cumin). Once the rat completes two consecutive sessions with at least 90% of the trials correct, he has met criterion for the NMTS procedure, and will be moved to the testing phase.

Testing Phase

A “list” of scents will be presented to the rat using the sample tray; they will be presented one at a time with a 15-sec interval between presentations. The list will start with five scents (ex: cumin, clove, savory, garlic, and carob). After they are presented, the rat will be presented with five NMTS probe trials. In each probe trial the rat will be presented with a scent from the list (familiar) and a scent that was not on the list (unfamiliar) using the comparison tray. The scents from the list will be presented in a randomized order so they are not in the same order as they were originally presented. For example, the first NMTS probe could be savory and paprika, and if the rat recalled that savory was in the list (familiar), then he should pick paprika. Each rat will be tested for 10 sessions with 10 different lists of scents. After the five scent list is presented for 10 sessions, the list length will increase (eg, 10, 15, 20).

Data Analysis

I will record the number of correct responses for each serial position over the 10 days and use a repeated-measures ANOVA to analyze whether performance is different for the different serial positions.

Description of the Product

This research is my honors project. I plan to write a scientific paper and present the work at a conference next year.

Works Cited

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Figure 1

