Applied Animal Behaviour Science 139 (2012) 242–250

Contents lists available at SciVerse ScienceDirect

Applied Animal Behaviour Science

journal homepage: www.elsevier.com/locate/applanim

Cognitive testing in horses using a computer based apparatus

Vivian Gabor*, Martina Gerken

University of Göttingen, Department of Animal Sciences, Ecology of Livestock Production, Albrecht-Thaer-Weg 3, 37075 Göttingen, Germany

ARTICLE INFO

Article history:
Accepted 15 April 2012
Available online 15 May 2012

Keywords:
Cognition
Ponies
Relational learning
Matching to sample
Automated learning device

ABSTRACT

For the study of higher order cognition, the matching to sample procedure presents an established method to test relational concept learning in several species. In the present study we designed a method of testing ponies via a computer based model. We used the advantages of an automatic stimulus control system which enabled a better standardization of stimulus presentation and sequencing, and shorter test periods for the animals. Three stages of learning were used to prepare seven Shetland ponies for matching to sample and final transfer tests. Learning criterion was set to 80% on two consecutive sessions including 20 trials per session. In the pretest, all seven ponies solved the operant conditioning task to push one of two buttons to receive a reward. Learning step 1 included the association between a stimulus presented on one side of a LCD screen and pushing the related button, which was accomplished by five ponies between sessions 8 and 55. Four individuals learnt the next step and were able to relate geometric symbols to each other in a matching to sample arrangement. In a subsequent test the ponies successfully transferred the learned task to completely new stimuli within 2–8 sessions with a performance level above 80%. We discuss several learning strategies which could have been involved in the observed learning process. The correct initial responses in the transfer tests suggest that ponies are able to acquire at least relational rules and transfer these to new stimuli.

© 2012 Elsevier B.V. All rights reserved.

1. Introduction

In modern farm animal husbandry, automatization has increased considerably. Food and water supply is offered through automatic feeders and drinkers and the animals must acquire a certain capability to operate these facilities. In the last decades, research on operant learning in farm animals involving automated learning devices has increased (Ferguson et al., 2009; Koba et al., 2009; Langbein et al., 2007; Manteuffel et al., 2009; Nielsen et al., 2009). Franz and Reichart (1999) and Langbein et al. (2006) showed that self-controlled visual discrimination and oddity learning is possible in dwarf goats. In their studies dwarf goats solved discrimination tasks by manipulating an automated learning device which was integrated in the group housing stable. Franz et al. (2002) outlined the advantage of this experimental design for testing larger animals compared to the "classical" learning devices like Skinner-box, Morris-water-maze or labyrinths. They described as advantages a flexible stimulus presentation, and the application of rewards to reinforce different types of learnt behavior.

The learning and cognitive abilities of horses have been examined in several studies conducted using wooden boards in which stimulus cards were attached. Either the horses had to open a flap to get the positive reinforcement (Gabor and Gerken, 2010; Hall et al., 2003; Sappington and Goldman, 1994), push a lever or directly touch the stimuli and receive the reward out of a feeding bowl (Flannery,

* Corresponding author. Tel.: +49 0 551 395610; fax: +49 0 551 395587.
E-mail addresses: vgabor@gwdg.de (V. Gabor), mgerken@gwdg.de (M. Gerken).

0168-1591/$ – see front matter © 2012 Elsevier B.V. All rights reserved.
http://dx.doi.org/10.1016/j.applanim.2012.04.010

1997; Hanggi, 1999, 2003; Hanggi and Ingersoll, 2009). Even if the procedure for reaching the reward for the positive stimulus was varied in different test designs, the stimulus presentation was predominantly manual. Hanggi and Ingersoll (2009) were the first to use stimuli presentation on LCD displays in horses and demonstrated that horses are able to perceive symbols when presented by a LCD screen. In this study horses showed a remarkable long-term memory in learning tasks after up to ten years.

Matching to sample (MTS) is a conditional discrimination procedure commonly used for testing higher cognitive abilities in different animal species (Iversen, 1997; Sidman et al., 1982; Zentall et al., 1981). To solve this task, the animal has to identify common characteristics among different stimuli, which involves greater cognitive ability than simple discriminations (Thomas, 1986). In a matching to sample arrangement one of the stimuli is identical to the sample and represents the positive one which is reinforced, while the second stimulus is used as a distractor. The distractor serves as negative stimulus and is unrewarded (D'Amato et al., 1985; Koehler, 1941; Murphy and Arkins, 2007).

Horses have shown stimulus generalization and discrimination learning (Dougherty and Lewis, 1991; Hanggi, 1999, 2001; McGreevy, 2004; Sappington and Goldman, 1994) and solved advanced cognitive tasks such as category discrimination (Hanggi, 1999, 2005; Nicol, 2002; Sappington and Goldman, 1994). Some degree of concept formation in horses has been shown by Hanggi (2003) where horses chose the larger one of two presented symbols and three-dimensional objects, respectively. Flannery (1997) was the first who reported a matching to sample procedure with horses.

In her experimental procedure the horses had to touch stimulus cards with their nose. However, the recording of the choices by touching stimulus cards was found to be imprecise because the experimenter could not easily detect if the cards were touched or not.

In higher order learning tasks it is of great importance to consider the attention span of the tested animal. In previous studies it was concluded that extended sessions of concentrated training schedules lead to an inefficient learning behavior in the horse (McCall, 1990; Rubin et al., 1980). But it has not yet been clarified in the previous studies how long in detail a horse could direct its attention to one task. With an automatized presentation of the stimuli it should be possible to reduce the time in which the animals have to be attentive and reduce the risk of failure by lack of attention.

Therefore the aim of our study was to evaluate if ponies are able to solve a matching to sample task using a computer based apparatus which presented the stimuli on a LCD flat screen.

We postulate that this method allows a more rapid presentation of different stimuli in a precise temporal sequence. Thus the present methodology involves two experimental improvements relative to previous attempts: reduction of the attention span needed to successfully solve the task and unequivocal recording of individuals' responses in the matching to sample problem.

Table 1
Ponies included in the experiment, name, sex, age and the participation in the learning steps.

Name	Sex	Age (years)	Participation in learning step
Flicka	Female	4	L1
Lisa	Female	3	L1
Luzi	Female	8	L1-T2
Ronja	Female	8	L1
Witti	Female	10	L1-T2
Bennie	Gelding	12	L1-T2
Moritz	Gelding	5	L1-T2

2. Animals and methods

2.1. Animals

The learning tests were conducted between May 2009 and August 2010 in stables of the Department of Animal Sciences, University of Göttingen, Göttingen, Germany. The study involved five Shetland pony mares (aged 3–10 years) and two geldings (5 and 12 years) (Table 1). None of the ponies had any previous experience in learning tests. The prior training history of the animals was unknown, as they were purchased from different sources. During the entire experimental period, the ponies were not involved in any other training activity such as riding etc. They were kept in the same group all year round and were fed hay (1 kg hay/100 kg BW) or alternatively grazed on pasture and thus were not food deprived over the experiments. Water was available ad libitum.

2.2. Experimental area

A room (6.40 m × 2.90 m), separated from the holding facilities served as testing area (Fig. 1). The test took place under semi laboratory conditions to avoid distraction of the testing animals by external factors, while also ensuring that ponies were not socially isolated during testing. For that purpose the room was divided into a waiting area and a testing area separated by a rope. Inside the testing area, the apparatus was placed in a corner, while in the waiting area 2 companion animals remained. Light was provided by windows and additional artificial lights.

2.3. Apparatus

The main equipment used was a LCD flat screen (LG Flatron LCD 577 LH, 15.1 in.) attached to a computer (Intel Pentium 4, 2.0 GHz, 1.0 GB RAM), two buttons just below the screen for indicating decisions of the ponies and a food bowl for reinforcement (Figs. 1–3). Display resolution was set to 1024 × 768 and refresh rate was 75 Hz. For protection of the LCD display, Plexiglass was placed in front of the screen similar to Hanggi and Ingersoll (2009) and the buttons were inserted below the screen into the glass (Fig. 2). For reinforcement the experimenter put 10 g of concentrate pellets (DERBY Standard: 10.5 MJ DE; crude protein 11.0%) into a tube, which led to the bowl. The experimenter could control the process of the stimuli presentation on the LCD screen by a keyboard.

Download English Version:

https://daneshyari.com/en/article/6379746

Download Persian Version:

https://daneshyari.com/article/6379746

Daneshyari.com