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Social discrimination of familiar conspecifics by juvenile pigs, *Sus scrofa*: Development of a non-invasive method to study the transmission of unimodal and bimodal cues between live stimuli

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Abstract

A non-invasive method was developed to study the transmission of cues that are used in social discrimination by pigs, *Sus scrofa*. We investigated the ability of juvenile pigs to discriminate between pairs of familiar, similar-aged conspecifics in a Y-maze learning task, using either single or paired visual, olfactory and auditory cues. The stimulus pigs ($n = 12$) were littermates that were familiar but unrelated to the test pigs ($n = 12$). For the bimodal task, test pigs (four per treatment) were presented with cues of two modalities: olfaction and vision (OV), vision and audition (AV), or audition and olfaction (AO). Approaches to a pre-determined correct stimulus were rewarded with food in daily sessions, each of 10 consecutive trials. Three consecutive successful sessions of $\geq$8/10 correct choices ($P = 0.00016$) fulfilled the criterion for starting the unimodal task, during which test pigs were given either olfactory, visual or auditory cues only using the same success criterion. Eight pigs learnt the bimodal task (OV: 4, AV: 2, AO: 2) of which six pigs subsequently completed the unimodal task successfully (O: 3, V: 2, A: 1). These findings indicate that juvenile pigs have the cognitive capacity to discriminate between same-sex littermates that are also familiar group-members in the absence of either visual, olfactory or auditory

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cues, and that some can use just one of these modalities. A larger-scale study is needed to determine the sensory hierarchy of social discrimination in pigs.

Keywords: Pig; Learning; Social discrimination; Y-maze

1. Introduction

Social stability in small (<30) groups of juvenile pigs relies upon the swift and decisive determination of dyadic relationships following mixing, as well as the ability to continue to discriminate different group members. The ability to discriminate between individuals begins shortly after birth with the piglet able to distinguish its dam from other sows using initially olfactory, and then auditory, cues (Horrell and Hodgson, 1992b; Walser, 1986). As pigs mature, cues used in social discrimination become increasingly multimodal with groups apparently able to function socially, albeit in a modified fashion, when one or more modalities are disrupted. Meese and Baldwin (1975) and Ewbank and Meese (1974) used contact lenses, hoods or surgical ablation of the olfactory bulbs to demonstrate this, although such invasive procedures may have affected the pigs' social behaviour in a number of ways, e.g. by impeding navigation, increasing fearfulness, or interfering with social discrimination.

Several studies have shown that pigs are able to discriminate between familiar and unfamiliar conspecifics using various cues, e.g., urine, faeces, bedding material (Horrell and Hodgson, 1992b), recorded vocalisations (Illmann et al., 2002), whole body odours and live conspecifics (Kristensen et al., 2001). These and similar studies rely on subjects responding more vigorously to one stimulus than the other, spending longer investigating one stimulus over another, or showing a functional response such as aggression towards the unfamiliar animal. Such differential responses might be expected given that one of the stimuli may be novel; however, this approach can also give ambiguous results or poor repeatability due to conflicting motivational priorities, differing preferences according to context, neophobia, the emotional state of the subject during the test, or individual differences in propensity to show aggressive behaviour. Also, the approach lends itself less readily to studies of group-member discrimination where both stimuli are equally familiar.

Given the limited availability of cues (excepting large weight advantages) that predict success in agonistic encounters (Andersen et al., 2000), it is often assumed (e.g. Jensen, 2002), and seems highly likely, that pigs discriminate between group-members by recognising individuals according to their individually unique characteristics (see Zayan, 1994), although this has never been demonstrated explicitly. Furthermore, the cues that pigs use and need for group-member discrimination are unknown, hence the focus of this paper on cue use by pigs in a social discrimination task.

Although olfaction is thought to be the dominant sense used in pig social communication (Jensen, 2002), pigs use visual cues when signalling aggression and submission (Jensen, 1982; Jensen and Woodgush, 1984) and produce many vocalisations, of which at least one appears to have individually unique characteristics (Blackshaw et al., 1996) and could therefore be used in individual recognition. Encounters between two unfamiliar pigs often end in overt aggression. They are characterised by a nosing phase, in which individuals repeatedly touch and sniff one another, especially on the facial and anal-genital regions; and a biting phase (Jensen and Yngvesson, 1998), in which they butt the head and body, bite (especially the head and ears), press and lever, until one pig signals submission and retreats (Rushen and Pajor, 1987). Nosing is