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Hens are motivated to dustbathe in peat irrespective of being reared with or without a suitable dustbathing substrate

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Birds usually dustbathe in litter, but in the absence of this they sham dustbathe. The question addressed in this study was whether laying hens, *Gallus gallus domesticus* reared without litter and used to performing sham dustbathing consider this to be 'real' dustbathing and are satisfied with this or, if given the opportunity, would choose to dustbathe in a functional substrate? We used the push-door as the operant method to quantify motivation to dustbathe in 28 adult laying hens from four different treatments. The treatments reflected different previous experiences of litter and were based on the time period during rearing that birds had been housed with access to peat: (1) never, (2) early rearing, (3) late rearing and (4) always. All hens were deprived of peat before the start of the test, which was carried out when the birds were adults, and they were tested every fifth day in a series of trials with increasing resistance of the push-door. A hen was removed from the test when she no longer successfully pushed through the door. The results showed that there was no difference between treatments in the weight of doors that hens pushed open to gain access to peat. This implies that sham dustbathing is not satisfying or perceived as normal dustbathing, even for birds that developed dustbathing behaviour in the absence of litter because birds that had no previous experience of peat were as motivated to work to gain access to this substrate as birds used to dustbathing in peat.

Keywords: behavioural need; domestic chicken; dustbathing; *Gallus gallus domesticus*; push-door; rearing; welfare

Dustbathing is a maintenance behaviour consisting of several behavioural elements whose performance results in dust collecting between the feathers. The dust is then subsequently shaken off which reduces the amount of feather lipids and so helps the plumage maintain good insulating capacity (van Liere 1992a). The preferred time and place for dustbathing is in the middle of the day in a dry crumbly substrate and hens, *Gallus gallus domesticus*, living under natural conditions perform dustbathing every second or third day (Vestergaard 1982). For wild birds it is essential that their plumage is kept in a good condition, but for domestic hens kept indoors this is of less importance for their survival. Despite this, there are strong indications that domestic hens are highly motivated to perform dustbathing behaviour (Olsson & Keeling 2005) and when reared and kept in cages with no access to litter they perform sham dustbathing on the wire floor (van Liere 1992b; Olsson et al. 2002a; Merrill et al. 2006). Therefore it can be questioned how these birds, which have never had the possibility to dustbathe in a functional substrate, perceive sham dustbathing; do they want something they have never had (i.e. litter) or are they content to sham dustbathe?

Hens' motivation to dustbathe can be influenced by different factors such as internal behavioural needs (Hogan et al. 1991), external factors such as light (Duncan et al. 1998) or the sight of litter (Petherick et al. 1995) and the amount of feather lipids (van Liere 1992a). Concerns have been raised about the welfare of birds that are kept without litter material (e.g. in conventional cages) or with limited access to litter (e.g. furnished cages) and perform sham dustbathing (Lindberg & Nicol 1997; Olsson & Keeling 2005). But is this concern justified? Several

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experimental studies have investigated motivation of birds to gain access to litter but these have given somewhat ambiguous results. When given a simple choice between areas with litter and without litter, birds usually chose the litter (Dawkins 1981, 1983), but previous experience of litter influences the preference for different substrates (Sanotra et al. 1995). In a choice situation where birds, reared on either litter or wire, could choose to enter an area with peat or wire in a Y-maze, birds with previous experience of peat chose peat and the wire-reared birds chose wire (Petherick et al. 1990a). Furthermore when chicks reared on wire were presented with peat, sand and chicken food for dustbathing, five of 11 chicks did not dustbathe in any of the substrates and nine of 11 chicks sham dustbathed on the wire in their home pens (Vestergaard & Baranyiova 1996). In combination these results imply that sham dustbathing may be 'normal' dustbathing for these birds, although it has been shown that if birds gain access to litter over a longer time they change their preference and begin to use the more functional substrate for dustbathing (van Liere 1992b; Vestergaard & Lisborg 1993).

Different types of operant studies have been used to test birds' motivation to work to gain access to litter. In a preference test hens were given the opportunity to choose between food and litter when they had been food deprived for different lengths of time. Birds chose food even when they had been deprived for only a short time (Dawkins 1983). In another study (Dawkins & Beardsley 1986) birds were supposed to peck a key to gain access to litter but showed poor learning and did not seem able to connect the task with the reward. Lagadic & Faure (1987) showed that birds could learn to peck a key to enlarge their cage but that the birds did not peck more if they also gained access to litter. Contrary to this Matthews et al. (1993) found that hens would peck a key to gain access to peat and, judging by the slope of the demand function, it was more important for the birds to gain access to the substrate to perform dustbathing than to perform pecking and scratching. Supporting this finding is a study, using the push-door as operant method, where laying hens showed a relatively inelastic demand for dustbathing in peat (de Jong et al. 2005). Widowski & Duncan (2000) also used push-doors to study whether the weight that hens pushed to gain access to peat depended on whether they were litter deprived. The birds tended to open heavier doors when they were deprived and significantly more of the hens dustbathed when deprived. However, some hens opened heavier doors when they were not deprived. These results support the view that hens are willing to work to gain access to litter but not necessarily that they are willing to work more because they are deprived. The authors explained their findings using a model on motivational affective states (Fraser & Duncan 1998) and suggested that birds dustbathed to increase pleasure when given the opportunity rather than having a 'need' which if not fulfilled would lead to suffering.

There should be clear benefits for animals' survival in the wild to know about resources even if they are not within sight and it is well known that food-hoarding birds are able to return to several different caches a long time after the food was placed there (Healy et al. 2005). There is also some evidence that for example wild baboons can plan their travel routes and visits to out of sight resources (Noser & Byrne 2007). This implies that animals can know where they are heading and why, so it is not unreasonable to speculate whether chickens know the location of a suitable dustbathe even if they do not see it. Afterall, dustbathing behaviour is important for maintaining a good plumage and so ultimately for survival, but birds need to return to the location of the dusty substrate only every second or third day. In a study by Petherick et al. (1990b) hens were trained to associate peat with a colour cue. When birds were tested several times during a short time six of 15 hens learned the task and then ran faster when their previous choice had given them access to peat. This indicates that the birds might have had some cognitive representation of peat when it was out of sight. Supporting this is also the finding that litter-deprived hens spent longer time exploring a bare tunnel than did hens that were not deprived (Nicol & Guilford 1991). However, these studies are based on animals with previous experience of the resource. Such a study has not been carried out using birds naïve to litter material, but a study has been done with birds naïve to a nestbox. Comparisons between prelaying behaviour in birds that had experience of a nestbox and birds that had never experienced a nestbox showed that experience did not affect expression of prelaying behaviour (Cooper & Appleby 1995). This study therefore could support the argument that birds have a perception of a nest even if they have previously been housed in a barren cage. It has been suggested that the onset of nest building is endocrinologically influenced but that the later phase is affected by environmental feedback (Jensen & Toates 1993). Even if the onset of a behaviour is started by hormonal changes or some other internal motivation, the interesting question is whether an animal that has never seen a nest before or performed dustbathing in litter has an image of what a nest should be like or what a functional dustbath should feel like. In other words do they 'know' what they aim or search for when motivated to perform a behaviour requiring a specific resource and would they then miss it if they do not find it?

Whether animals can miss what they have never had is almost impossible to answer because by default once they have encountered the resource it is not unknown to them anymore, and as far as we know there is no method available to test whether an animal wants something without presenting it to them. However, in this study we investigated whether birds that have no previous experience of litter and have learned to perform dustbathing without this resource would recognize a suitable dustbathing substrate when they first encounter it and whether they then would work to get further access to this substrate? Also we included in the study birds that had access to litter during the period that most of the dustbathing behaviour develops and birds that gained access to litter after this period to investigate how the timing of access to litter would affect later motivation. Our aim was to determine whether birds used to performing sham dustbathing consider this to be 'real' dustbathing. This