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# Wild European Starlings (*Sturnus vulgaris*) Make and Use Woolen Tools

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**Abstract –** This study reports the novel manufacture and use of tools by wild European or common starlings (*Sturnus vulgaris*) in mainland Orkney, Scotland. On two occasions over a period of ten days, multiple starlings picked off and applied pieces of discarded sheep's fleece to the area under their wings and tails, in a manner similar to widespread 'anting' behavior. The birds' goal is unknown, but it is likely that they are using the woolen tools for feather maintenance or another form of self-care. These observations reflect a previously unreported form of tool use in European starlings, which was rapid, repeated, and performed by several members of a flock.

**Keywords –** Common starling, Wool, Sheep, Self-care, Avian tool use

European or common starlings (*Sturnus vulgaris*) are among several bird species known to engage in anting behavior, which involves using ants as tools (McAtee, 1938; Shumaker et al., 2011). In its active form, the birds pick up live ants in their bill and directly apply or rub the insects on their feathers, while in passive anting, the bird exposes their feathers while stationary at an ant nest, trail, or smoke source (Prideaux, 1947; Whitaker, 1957). The most common explanations for these actions in starlings are that anting helps with feather maintenance by cleaning feathers of material such as parasites or debris, that it assists with the moulting process, or that it acts as a means of removing ant acids before the bird eats the ant.

The feather maintenance hypothesis is suggested by the anti-parasitic and anti-fungal nature of various ant secretions, although there are few empirical tests of this hypothesis. Moulting birds have been seen anting, but the link is not yet indisputable (Potter, 1970). The food preparation hypothesis is supported by experimental trial (Judson & Bennett, 1992), but less well supported by instances of starlings using inedible items in a typical anting fashion. A previous example includes anting with naphthalene mothballs used to control garden pests (Clark et al., 1990), which may indicate that starlings use smell to identify suitable anting materials. Anting appears to be a widespread and an individually acquired skill among European starlings (Simmons, 1966).

There is one report of a wild European starling using a tool in a non-anting manner. Niemeyer and Kingery (2003, p.71) saw a bird with "a piece of twig in its beak about an inch and a half long, held sideways. The bird used the twig much like the other starlings simply used their beaks - to rake or rummage through the dirt and grass litter." The starling at one point dropped the twig, appeared to eat something from the ground, then picked up the same stick and continued scraping with it. The twig was tentatively identified as a piece of sumac (*Ailanthus* sp.) leaf stem. There are no reports of wild starlings actively making tools from inedible materials.

Here, I report a novel type of tool manufacture and use by wild European starlings in Orkney, Scotland. Multiple birds picked apart discarded pieces of domesticated sheep (*Ovis aries*) wool, and used the remnants in a fashion very similar to reports of anting. These initial observations do not allow a definitive declaration on why the starlings used woolen tools, but lay the groundwork for future study of this behavior.

## Methods

### Ethics Statement

The study involved direct observation (Gruber, 2023), however, no contact was made with the animals and the birds' behavior was not influenced or constrained in any way. The environment was not modified for the research. As such, ethical approval from an animal use committee was not required for this study.

### Study Site and Observations

The author observed European starlings opportunistically at the agricultural property of Howe, Evie, in northwest mainland Orkney (59.11668° N, 3.11979° W), just after 8AM on 19 and 29 September 2022. The author was living in a rented cottage on the site for three weeks encompassing this period and observed the birds through a closed glass door at the property. The observation site was an approximately 3m x 4m area paved with large sandstone flags with grass and moss growing in the cracks, beside a 2m tall wooden fence. On the other side of the fence was discarded brown sheep's fleece that could be accessed under the fence from the paved side (Figure 1). Small pieces of wool were already separated from the main fleece and sparsely scattered at the site before the first observation of tool use, but the Orcadian winds typically moved any loose material into the fringing grass after a few minutes. One stringy section of wool was also hooked on a natural spur at the top of the fence, which may have arrived there via either wind or carried by birds (Figure 2). Starlings visited the area daily, flying overhead, foraging in the surrounding fields or perching on the roof of farm buildings, but were only seen in the paved area on the two reported days. It is possible that the birds visited the site at other times, after the author left for work each day at around 8.30am. Birds were watched from a range of 5-10m, using a handheld Canon EOS 70D camera for photos and videos.

**Figure 1**

*Wool Tool Use by Wild European Starlings*


*Note.* (a) the foreground bird has a piece of wool in its bill; the background bird is using wool in an anting manner under its left wing, with its tail also spread to the left; (b) the foreground bird is using a tool under its right wing; the background bird is still holding its woolen tool. Both photographs show the site layout of sandstone flags, with the original discarded sheep's fleece visible under the fence at the top left. The letters *a* and *b* mark the fleece location.

**Figure 2**

*Wild European Starlings Making Woolen Tools on Top of the Fence Beside the Study Site*

*Note.* A section of fleece was caught on the fence, and both photographed birds plucked at the wool to make a tool.

## Results

On both reported days a group of up to six birds visited the site. The starlings were not individually identified, with a minimum of three birds using woolen tools based on recorded videos. Because of the opportunistic recording, no further qualitative data are available.

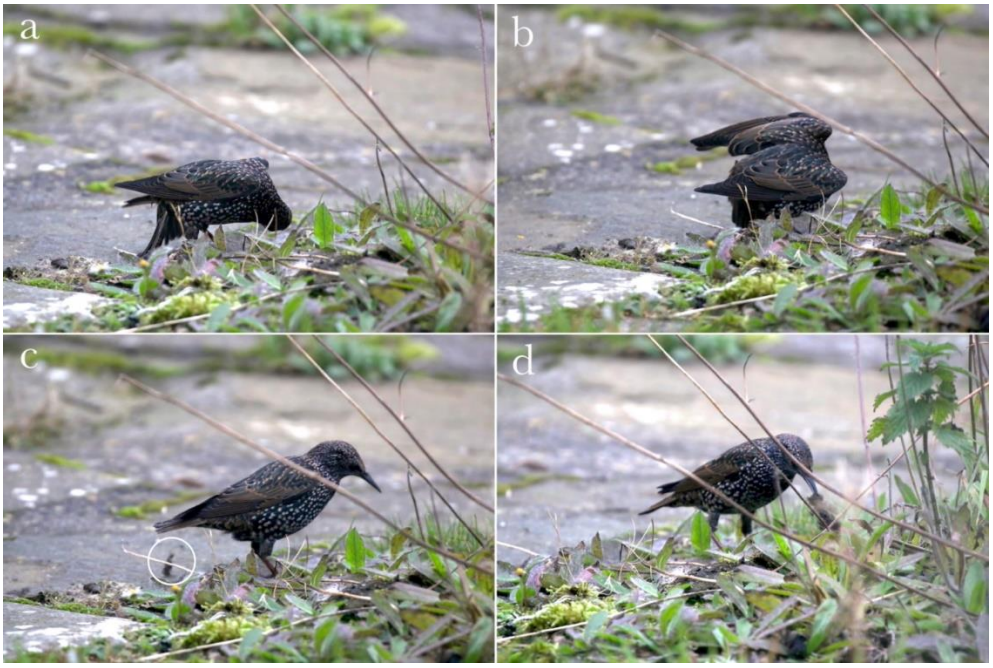
Tool use involved a starling moving to a small piece of wool on the ground or detaching a new piece from a larger clump by tugging and picking apart the fibres (Figure 3). With the wool in its bill and its body held roughly horizontally, the bird then tucked its head under one wing while fanning its tail towards the same side and made a series of rapid agitating or stroking movements. These included movements along the wing feathers and appeared to include the tail. After each application, typically performed on one side only, the bird usually discarded the wool by releasing it from the bill with a tossing motion (Figure 4). However, in one instance a starling kept hold of its tool and added more wool from a nearby clump before continuing to perform the under-wing behavior (Video S1). No bird directly pulled a wool tool from the main fleece during the observation period, but previous instances of that behavior can be strongly inferred from the scattered fleece fragments at the site.

**Figure 3**

*A Wild European Starling Making a Tool by Plucking at Discarded Sheep's Wool*

**Figure 4**

*A Wild European Starling Making and Using Woolen Tools*




*Note.* (a) the bird has a small woolen tool in its bill and is preparing to use it under its left wing; (b) the bird actively 'anting' with the wool under its left wing, with its tail splayed to the left; (c) the bird has finished with and discarded the tool—circled—behind it; (d) the bird moves on to a new piece of wool found in the grass and begins plucking at it to make the next tool. This sequence took about 5 seconds.

Tool-using birds moved sequentially from piece to piece around the site, sometimes removing a fleece fragment to perform the tool-use activity, and sometimes moving on after pulling at a clump of wool for a second or two without creating a usable tool. The decision whether to use an encountered fleece piece was rapid, but the factors influencing that decision are unclear. Birds engaged in a sequence of tool-use behavior did not seem to be haphazardly stumbling across the wool pieces; they moved directly and quickly from one piece to another (Video S2). The starlings sometimes picked at pieces of wool in the vicinity of previous tool use by another bird, although from these initial observations I could not be certain that any given piece of wool was re-used by a second animal. Neither was there clear evidence whether individual birds learned the behavior from each other, or had developed it individually.

Alongside tool use, the starlings also occasionally pecked at the ground, presumably feeding. No bird was seen anting or preening at the paved observation area without wool, although during the observation period one starling did preen its primary feathers with its bill on a nearby roof. On each observation day the starlings remained at the site, using tools, for under 10 minutes before flying off. During this observation period, none of the birds removed wool from the site for use elsewhere.

## Discussion

This report is the first of European starling tool manufacture using inedible material. Both reductive (splitting) and additive (combining) tool making were displayed by the Orkney birds. Multiple starlings proved capable of visually discerning the usefulness of a fleece piece, manually assessing its size and manipulability, and then either using the wool as found or making a useable tool out of the whole. However, the ontological and physiological processes contributing to this behavior remain to be discovered, and any claims of its relevance for starling cognition would be premature.

Each starling's stance and movement during wool tool application match that described by Poulsen (1956) for anting behavior in general, and closely resemble photos in Simmons (1966, Plate 1b) and in Wiles and McAllister (2011) in which European starlings are anting with their head under their left wing and the tail splayed to the left side. It is therefore reasonable to hypothesise that wool tool-use in Orkney is happening for similar purposes to anting behavior.

The discarded fleece is from a local breed of North European short-tailed sheep (see Dýrmundsson & Niznikowski, 2010). The wool was not treated through scouring or chemical preparation prior to its discard, but it was exposed to the weather for an unknown amount of time. Sheep's wool contains lanolin, a waxy mixture of fatty acids and alcohols (Schlossmand & McCarthy, 1978), which were likely present on the wool used by the starlings. Water-soluble suint, resulting from the animal's sweat and dirt, was not as obvious on the wool, perhaps because Orkney's regular rainfall had rinsed the fleece.

Starlings are resident year-round in Orkney, and in 2022 were the most commonly sighted bird in Orkney during the annual Big Garden Birdwatch organised by the Royal Society for the Protection of Birds (RSPB, 2023). Sheep are also common, with the 2021 Scottish Agricultural Census counting over 130,000 animals in a total area of under 1000 $km^2$ (Scottish Government, 2021). The author has observed starlings foraging in several fields across Orkney that also have sheep and scattered wool pieces. The wool accumulates on wire fencing and tough vegetation and can persist for months at a time, even after sheep have been moved to another field. Although not directly observed, online images show that starlings do occasionally perch on sheep, opening up another potential route for wool exposure. This readily available material might lower the threshold for starlings to encounter and assess the usefulness of wool. Mainland Orkney is frequented by birdwatchers and has numerous dedicated birdwatching sites maintained by the RSPB, which suggests that either (i) starling wool tool use is regularly seen in the archipelago but has not been previously recognised and reported; or (ii) this form of tool use is uncommon, perhaps sporadically emerging and subsequently lost in certain groups.

Starlings naturally oil their feathers via the uropygial gland during preening, which leaves an odor that may be recognisable to the birds (Amo et al., 2012). Preening has a proposed antimicrobial role, achieved either through the effect of gland secretions themselves or through symbiotic bacteria in the gland (Rajchard, 2010), along with feather protection and sheen-enhancing effects (Sweeney et al., 2004). The

Orkney starlings may therefore have been using their woolen tools to either apply lanolin to their feathers, or to assist with spreading secretions from the uropygial gland. Alternatively, or in addition, the birds may have been using the wool as a mechanical scraper to physically clean their feathers, or to obtain satisfaction or relief from using the wool. The observations took place after the typical starling moulting period, but no connection between moulting and the tool use could be made from the limited observations.

European starlings are known to favor fragrant and health-supporting materials. For example, nestlings are healthier when males incorporate fresh aromatic herbs into their dry grass nests (Gwinner & Berger, 2008). However, the direct use of non-ant objects for self-care in this species seems to be rare or underreported. Given that multiple birds made and used woolen tools on both observation days, woolen tool use may be currently habitual among at least some Orkney starling groups. Note that the wool tool use differs from the one reported instance of stick tool use in starlings, which was directed at the ground and not the bird itself. Several reports of parrots and cockatoos using stick tools, and other hard materials, to scratch themselves are summarised by Shumaker et al. (2011), and there is a disputed report of a puffin touching itself with a stick tool (see Sandor and Miklosi, 2020). Available descriptions and photos of those behaviors do not match the wool tool use seen in Orkney, which instead closely compares to reported starling anting behavior.

Poulsen (1956) reports European starlings successively picking up ants during an active anting bout, and not discarding them after use, resulting in a wad or ball of ants in the bill that was then discarded or swallowed. In form, the ant ball can be viewed as a kind of combination or compound tool. The entwined woolen fibres of the starling tools could be placed within the same technological classification, although wool is not a normal part of the starling diet. Making the woolen tools involves the Orkney birds directing their attention at a natural material with the apparent sole purpose of using it for self-care.

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**Conflict of Interest:** The author has no conflict of interest.

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## Supplementary Material

### Video S1

*A group of wild European starlings making and using woolen tools.*

https://doi.org/10.6084/m9.figshare.25238509.v1

### Video S2

*A wild European starling using successive woolen tools as it moves around the study site.*

https://doi.org/10.6084/m9.figshare.25238512.v1