

Preliminary Study on Preferences for Hollow vs. Filled Social Partners in Domestic Chicks

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Abstract

Human infants as young as 8 months old are surprised when animated objects have no insides. This observation has suggested that infants might attribute biological properties such as “having an inside” to animated objects. Do chicks (*Gallus gallus*) exhibit similar biological expectations for social partners? In a series of experiments we take advantage of social motivation of newly hatched chicks to investigate whether: (a) naïve chicks exhibit an unlearned preference for hollow vs. filled social objects; (b) visual experience and imprinting affects the preference for hollow vs. filled objects; (c) how imprinting on hollow, filled or occluded objects influences filial responses. We show that naïve chicks exhibit an unlearned preference to approach hollow objects, irrespectively of their visual experience, that this preference is maintained in imprinted chicks and partially modulated by imprinting. Our data show that “being filled” is not a requirement of social stimuli and that a short experience can influence the preferences for social partners in these precocial birds.

Keywords: animacy; unlearned preferences; imprinting; insides; *Gallus gallus*.

Introduction

Mounting evidence shows that animals are not blank slates passively shaped by environment and experience (reviewed in Vallortigara, 2012). On the contrary, living beings come to this world endowed with knowledge that prepares them to cope with the environment that their ancestors encountered during their evolutionary history. Naïf individuals of social species – such as human infants or chicks of precocial species like the domestic fowl – have been shown to possess unlearned knowledge that orients them towards conspecifics that can help them in surviving. This knowledge includes mechanisms to orient towards face-like stimuli (Di Giorgio, Leo, Pascalis, & Simion, 2012; Rosa-Salva, Regolin, & Vallortigara, 2010), biological motion (Simion, Regolin, & Bulf, 2008; Vallortigara, Regolin, & Marconato, 2005), self-propelled objects (Mascalzoni, Regolin, & Vallortigara, 2010). Overall, evidence points at the presence of a mechanism sensitive to cues of animated objects that correlate with the presence of caregivers.

Recently Setoh, Wu, Baillargeon and Gelman (2013) have suggested the existence, in infants 8 month-olds, of expectations about some biological properties of animated objects. In their study infants detected a violation of expectations when a self-propelled and agentive object (but not an object that lacked at least one of these properties) was revealed to be hollow instead of filled. The authors

suggested that young infants’ expectations about animals having filled insides may serve as a foundation for the development of more advanced biological knowledge. It is not clear though whether these results can be explained as the effect of 8 months long experience with animated and filled caregivers. Moreover, if the suggested unlearned expectations had been shaped by selection, we would expect to observe them in other social species.

Here we use chicks of the domestic fowl to investigate the generality of the expectations for animated objects to be filled, and its independence from experience. As a model of animated objects we use orange cylinders that have been showed to work well as imprinting objects (social partners). We test whether: (a) naïve chicks exhibit an unlearned preference for hollow vs. filled social objects; (b) imprinting affects the preference for hollow vs. filled objects; (c) how imprinting on hollow, filled or occluded objects influences filial responses.

Materials and methods

Subjects/conditions

One day old chicks (*Gallus gallus*) kept with no interactions with conspecifics, either with aspecific experience (dark-reared or exposed to light only) or imprinted for 24 hours:

- DARK-reared
- exposed to light only (LIGHT)
- imprinted on OCCLUDED stimulus (chicks could not see whether the object was hollow or filled during the imprinting phase. The object was displayed horizontally and its far ends were occluded with an opaque white screen)
- imprinted on HOLLOW stimulus
- imprinted on FILLED stimulus

Imprinting/test objects

Imprinting and test objects were orange plastic cylinders (12 cm, ϕ 4 cm). Hollow stimuli had a white inside, filled stimuli were identical with a white stopper on both sides. During the imprinting phase stimuli were presented behind a transparent window, thus tactile interactions were prevented.

Test apparatus and procedure

We tested chicks in a rectangular apparatus (85 × 30 cm) with three sectors: centre (15 cm), right (35 cm), left (35 cm), as shown in Figure 1. At test chicks could make contact with the objects located at the sides of the apparatus.

During the test one hollow and one filled stimulus were presented in the side sectors, alternating the side of presentation between subjects. Each chick was tested only once. We located a single chick in the central sector and then recorded its behavior for 360 seconds.

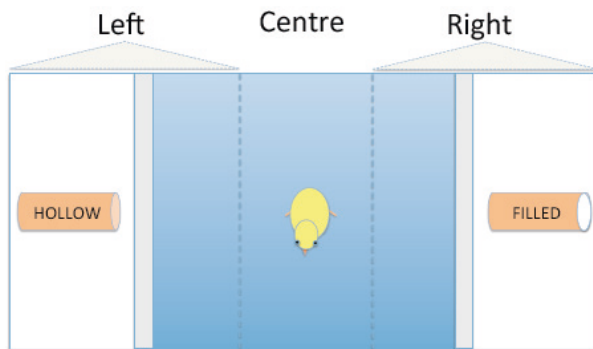


Figure 1: test apparatus, virtually divided in Left sector, Centre (where the chicks is located at the beginning of the trial) and Right sector. Chicks which trespassed a central line with both legs in a 6 minutes period were scored for their first choice (hollow or filled).

Data analysis

For each chick that trespassed the central sector with both legs we recorded (a) the first choice (for the hollow or filled object) and (b) the proportion of time spent close to the hollow stimulus, hollow index:

$$\text{Hollow time}/(\text{Hollow time}+\text{Filled time})$$

For the proportion of time spent at the hollow stimulus we used ANOVA on the values of the hollow index x experimental condition, and one-sample t-tests against the chance level (0.5).

Results

Either chicks with aspecific experience (dark-reared chicks and chicks exposed to light only) and imprinted chicks (occluded, hollow, filled) exhibited preference to approach the hollow stimuli: aspecific experience = $p_{\text{binomial}} < 0.001$; imprinting exposure $p_{\text{binomial}} < 0.001$.

In the aspecific experience experiment, the ANOVA on the proportion of time spent by the hollow stimulus shows no effect of experimental condition ($p = 0.124$, Figure 2A). The overall population exhibits a preference for approaching the hollow stimulus: $p < 0.001$. In the imprinting experiment we have identified a trend for differences between imprinting conditions (Figure 2B). The overall imprinted population exhibits a preference for approaching the hollow stimulus: $p = 0.008$.

Discussion

Setoh et al. (2013) suggested that the presence of innards can be a feature that inexperienced infants expect in animated objects. We show that one-day old visually

inexperienced chicks and chicks exposed to light and imprinting stimuli display a preference to approach hollow vs. filled objects. Overall, our data show that “being filled” is not a necessary requirement of social stimuli – at least this is not a general feature shared across different taxa and species such as the animacy cues like biological motion, face-like patterns or self-propelledness.

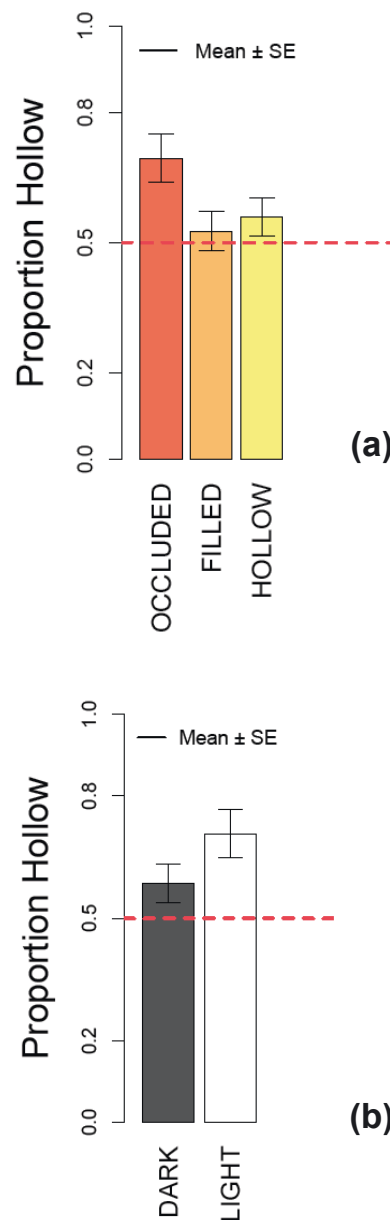


Figure 2: Proportion of time spent by the Hollow stimulus (Mean ± SE) for different treatments in (a) the aspecific experience experiment – dark reared chicks (DARK) and exposure to light only (LIGHT) – and in (b) the imprinting experiment: imprinting on occluded stimulus (OCCLUDED), filled stimulus (FILLED), hollow stimulus (HOLLOW).

On the contrary, chicks are more attracted by social partners with hollow insides. Differently from other unlearned preferences that have been reported to emerge after some specific experience (e.g. Vallortigara et al. (2005) tested chicks for biological motion preferences after an experience on the tapis roulant), the preferential orientation towards hollow stimuli did not require previous experience in our setting. Exposure to different imprinting stimuli seems to modulate filial responses, although a larger sample size is needed to investigate this effect.

The reasons for the overall preference for hollow objects have not been clarified yet, although it is possible that chicks of the domestic fowl have evolved a preference to approach as social partners objects that, similarly to the mother hen, can hide them. Previous evidence has in fact showed that chicks are aware of the properties of occluding objects (Chiandetti & Vallortigara, 2011).

We have planned further studies to understand the preference for hollow stimuli exhibited by young chicks. The possibility that chicks are attracted by cavities that allow them to hide is suggested by the fact that while exploring the hollow object they occasionally enter it with the head. To test this hypothesis we will evaluate the preference between hollow stimuli large enough to hide a chick and hollow stimuli too narrow to fit a chick, and for more naturalistic objects (i.e. imprinting objects with legs). Chicks might also be attracted by “more complex” stimuli, such as the shadows produced by the hollow stimulus, another variable that can be experimentally manipulated in subsequent studies.

Although in our limited sample we did not find significant differences between exposure/imprinting conditions (likely due to high variability between subjects), the fact that chicks imprinted on filled stimuli displayed the lower preference for hollow stimuli, and that chicks imprinted on occluded objects show a much higher preference for hollow objects suggest that visual experience with social partners can modulate the unlearned preference for hollow stimuli.

Further studies should be conducted to understand the role of filial experience in influencing preferences and expectation about the insides of social partners. Our study also suggests that further research is needed to clarify the role of experience in humans’ early expectations for filled objects.

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