Neither infants nor toddlers catch yawns from their mothers

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This study aimed to clarify whether infants and preschool children show susceptibility to contagious yawning, a well-known effect that has been demonstrated experimentally in older children and adults by exposing them to video sequences showing yawns. In a first study, parents kept a log of their child’s yawns for a one week period. None of the log entries reported any contagious yawns by the children. Although less frequent than in older children and adults, spontaneous yawning by infants and preschoolers showed the typical morning, post-wakening peak, and an increase before bedtime in the evening. In an experimental study, infants and preschoolers watched a presentation that included many images of yawning and a repeated video clip of their own mother yawning, but there was no evidence of contagious yawning. The results suggest that, even when witnessing yawns by someone with whom they have a strong and positive emotional relationship, very young children do not show contagious yawning.

Keywords: yawning; contagious yawning; infants; children; video; model

1. INTRODUCTION
Despite its ubiquity, human yawning remains poorly understood from psychological, functional and developmental perspectives [1]. With regard to the latter, yawn-like activity has been reported in the foetus [2]. Premature babies yawn less frequently than homeostatic control of sleeping and waking states improves [3]. Children in their first year of primary school yawned up to five times more frequently than in their final year of kindergarten [4]. According to parental reports, by the age of 12 years children yawn around nine times per day [5], which is similar to the 7–9 times per day reported by adults [6], but lower than the 11 and 23 times per day reported for adult ‘morning types’ and ‘evening types’, respectively [7].

One intriguing but understudied aspect of yawning in young infants is its so-called contagiousness. In adults, yawns seen on video induce yawning in approximately half of young adult observers [8]. Platek et al. reported a correlation between susceptibility to video-induced contagious yawning in adults and questionnaire measures of empathy [9]. In an experimental study of contagious yawning in children, there were no yawn-inducing effects of video yawn stimuli in children below 5 years of age; susceptibility increased throughout primary school years and reached adult-like levels by 12 years of age [10]. The absence of contagious yawning in preschoolers contrasted with earlier reports of imitation of facial (including mouth) movements by neonates and 1-year-olds [11,12].

In the study by Anderson & Meno [10] the yawning model in the video (a young adult female) was unfamiliar to the children. Given that model identity and empathy may be important factors in socially facilitated behaviour, including imitation [13,14], here we presented young children with a highly familiar yawning model, one with whom they are likely to have a strong and positive emotional relationship. This study had two principal aims. First, given the paucity of information on the spontaneous occurrence of yawning in preschool children, we asked mothers to keep a log of yawning by their children. Second, we assessed susceptibility to contagious yawning experimentally, using video stimuli in which the model was the child’s own mother.

2. STUDY 1: YAWN LOGS
As a first step towards establishing norms for the natural occurrence of yawning in preschool children, we asked mothers to record every yawn they witnessed in their child over a one week period.

(a) Material and methods
Twenty mothers whose children attended a university-run mother–toddler group were issued with a blank logbook and asked to record the occurrence, time and context of every yawn that they saw their child perform over a one week period. The children ranged from six to 34 months of age (mean: 15.5 months). The contents of the completed logs were then entered into a spreadsheet to show frequency of yawns across hours of the day, and contexts of yawns. Five contextual categories were defined: wakening (shortly after sleeping or napping), bedtime (preparing or settling down to sleep, including story time), mealtime (shortly before, during or after feeding), sedentary (sitting quietly, for example, on the floor or in the car), active (moving around, such as walking or lively play). Assignment of yawns to categories was agreed by consensus between the two authors.

(b) Results and discussion
A total of eight logs were returned and analysed (for five girls and three boys). The daily mean number of yawns recorded per child was 2.2 (s.e.: 0.55), with an absolute daily range of 0 to 7. Figure 1 shows the mean distribution of yawns across hours of the day. Yawns were most likely to occur in the morning between 7.00 and 9.00 h, shortly after wakening; this 2 h period accounted for over 35 per cent of all recorded yawns. Smaller peaks occurred between 10.00 and 13.00 h (21%) and between 15.00 and 18.00 h (20%), corresponding to daytime naps. There was also a small increase in frequency of yawning after 19.00 h, before bedtime. The most common context of observed yawns was wakening, either in the morning or after daytime naps (31.7% of all yawns), followed by bedtime (26.8%), mealtime (23.6%), active (9.8%) and sedentary (8.1%). None of the mothers made any reference to possible contagious yawning in their logs. Despite the small dataset, the distribution of yawns across hours of the day appears similar between the participants in this study and adults who recorded their own yawns [6,7]. In particular, the morning peak associated with wakening appears robust across

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Displaying on the slides. For example: stimuli by pointing to the screen and reading aloud verbal prompts. The mother was instructed to ensure the child's attention to the table, at a viewing distance approximately 30 cm from the monitor. Each child saw the smile presentation first. Each child sat with the mother at a presentation approximately one week apart, with one stimulus set presented in each session. The stimulus sets were presented on separate occasions, approximately one week apart, with one stimulus set that consisted of a series of Powerpoint slides showing images of individuals either yawning (experimental set) or ‘smiling’ (control set). The two sets were similar, consisting of six images of animals (six different species of mammal, matched across stimulus sets), six images of human babies, and the video clip of the mother, which appeared a total of five times at random positions within the set (see figure 2). All pictures of animals and babies were taken from the Internet, and were in colour. Each slide show lasted in total approximately 5 min, and all tests were carried out between 14.00 and 15.30 h.

### (b) Procedure

Each child was tested in a quiet room next to the playgroup on two separate occasions, approximately one week apart, with one stimulus set presented in each session. The stimulus sets were presented on the monitor, which was connected to the laptop computer. Quiet instrumental music played in the background. Time was recorded using a stopwatch, and any instances of yawning by the toddler were recorded directly on data sheets using pencil and paper. Half of the children viewed the yawn presentation first; the remainder saw the smile presentation first. Each child sat with the mother at a table, at a viewing distance approximately 30 cm from the monitor. The mother was instructed to ensure the child’s attention to the stimuli by pointing to the screen and reading aloud verbal prompts displayed on the slides. For example:

- Yawn slide 8: baby image + ‘What’s that?’
- Yawn slide 9: same baby image + ‘It’s a baby! Look. It’s yawning’

The experimenter (A.M.) controlled the laptop from approximately 3 m across the room and unobtrusively recorded any instances of yawning by the child. The children were also observed during free time in the playgroup for 5 min prior to and 5 min after the session, during which any yawns were noted.

### (c) Results and discussion

Sixteen of the 22 children showed no yawning during the study. None yawned during the smile presentation, but two girls yawned afterwards: one (29 months) yawned twice, and the other (six months, the youngest infant) four times. Two children yawned once during the yawn presentation: a girl (15 months; during slide 27: horse yawn) and a boy (nine months, during slide 3: gorilla yawn); another boy (36 months) yawned once post-presentation. We also showed the yawn presentation to 26 individually tested adults and asked them to record their own yawning. Thirteen (50%) reported yawning during the presentation, rising to 20 (76.9%) during the 5 min post-presentation period. Bearing in mind the differences in procedure, the difference in the total number of children and adults yawning is highly significant ($\chi^2 = 19.13$, $p < 0.001$). We also calculated 95% confidence intervals for the two groups (children: 4.7–33.3%; adults: 57.9–89%); these values again indicate the age-related difference in propensity to yawn to the yawn presentation.
4. GENERAL DISCUSSION
No parent who submitted a log made any reference to contagious yawning by the child. Furthermore, experimental exposure to yawn stimuli failed to induce yawning in preschool children. Together, these observations suggest that, as originally reported by Anderson & Meno [10], infants and preschoolers appear largely immune to contagious yawning, in marked contrast to older children and adults. Furthermore, the failure to show contagious yawning occurs even when the model is an emotionally significant one.

Although devoid of any reference to contagious yawning, the log data revealed young children’s natural ‘yawn profiles’ to be similar to those reported for adults. However, the overall daily mean frequency of yawns reported by parents for their children (2.2) was much lower than frequencies reported by adults recording their own yawns (7–9: [6]; 11–23: [7]).

Much higher frequencies of spontaneous yawning reported in schoolchildren [4,5], it seems likely that parents missed some of their child’s yawns, and/or disproportionately recorded yawns when in close proximity to the child, such as when putting the child to sleep, or at mealtimes. More research is required to clarify the normal daily range of yawns for young infants and preschool children.

The largely negative results from the video study confirm that infants and preschoolers are much less susceptible to psychological influences on yawning when compared with older children and adults [10]. This is in spite of the fact that the yawning model on video was the child’s mother; therefore, even a positive emotional bond with the model appears insufficient to elicit contagious yawning in very young children. This is one context in which the ‘Bonding- and Identification-based Observational Learning’ model [13] may not apply. The absence of contagious yawning in very young children suggests that different or additional brain mechanisms underlie yawning in older individuals, and also that neonatal and infant imitation of facial movements [11,12] are based on different neural mechanisms to those involved in contagious yawning.

It should be noted, however, that certain aspects of the experimental procedure might have reduced the likelihood of obtaining contagious yawning. For example, general arousal from attending to the stimulus presentation, including the novelty of seeing the mother yawning on the video monitor, might have inhibited yawning. Indeed, the artificiality of experimental video sessions may inhibit yawning in some adult participants (see [17]).

Researchers should, therefore, aim to increase the ecological validity of investigations into contagious yawning, such as by using live models, and incorporating various real-life contexts.

All procedures were approved by the University of Stirling Psychology Ethics Committee.

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