

## Tickling

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**Why do we laugh?** Laughter is a symptom of a positive emotion experienced, for example, during play, and is important in both children and adults. We have known for decades that play — which is not confined to humans; see articles in 25<sup>th</sup> anniversary special issue of *Current Biology* on the Biology of Fun (volume 25, issue 1) — contributes to children's social, emotional, and cognitive success (for example, Singer *et al.* 2006). Recent evolutionary theory suggests that positive emotions, such as those associated with laughter, have a number of benefits to the individual, such as fostering creativity and flexibility in thinking, increasing longevity, reducing the effects of health risks, and engendering increased likelihood of positive emotions in the future. Here we consider a particular kind of laughter-evoking play: tickling.

**What is a tickle?** A tickle is a type of touch that makes you laugh, isn't it? Actually, the word tickle refers to two classes of cutaneous sensation (Seldon, 2004): *knismesis*, a light spidery sensation that evokes a shiver or a twitch; and *gargalesis*, “the exquisitely intense, often pleasurable sensation in response to hard, rhythmic probing” (Leavens, 2009). Lightly scratching a cat under its chin apparently evokes the knismesic-type of tickling pleasure, which in human adults can range from pleasurable (a lover blowing into your ear, for example) to startling (when you realise a spider is crawling across your skin, for example). It is the gargalesis-type of tickling, however, that elicits unrestrained laughter.

***Do other animals tickle?*** Many animals appear to share with our own children the exquisite, yet paradoxical delight in response to tickling, including rats (for example Panksepp and Burgdorff, 2003), cats, sharks, and notably, the great apes (Davila Ross *et al.*, 2009). Cats will sometimes solicit tickling from their owners — rubbing their chins on one's hand, for example. But only great apes have been reported to regularly tickle others; indeed, one of the earliest communicative signals that chimpanzees learn to use is the 'tickle solicit' (Bard *et al.*, 2014).

In the 1970s, the development of the 'tickle solicit' behaviour was observed in wild infant chimpanzees (Plooij, 1979). When a mother tickles her very young infant in the side of the neck, which becomes a favourite tickle spot in juveniles, the infant smiles and brings his/her arms up, with the hands protecting the neck. The infant adopts this posture regularly and repeatedly across the first months of life while being tickled. Just before the first birthday, however, a new behaviour emerges, the infant begins to display this body posture while smiling *in advance of being tickled*, manifestly using this 'tickle solicit' gesture, to communicate their desire to be tickled.

In apes, tickling is distinct from other touching activities, such as grooming, and is clearly a kind of play, evoking smiles (commonly called play faces in non-human primates) and laughter (sometimes called pant grunts). Tickling play begins early in life as do smiles (as early as five weeks of age) and laughter (as early as eight weeks of age, Bard *et al.*, 2014). Interestingly, infant chimpanzees rarely tickle others; tickling is frequently initiated by mothers and other older chimpanzees toward infants. So while infant chimpanzees actively solicit tickling from others, they do not actively tickle others until they are older.

***Do animals laugh in response to tickle?*** We know that some animals do laugh when tickled; for example, rats emit special ultrasonic vocalisations when they are tickled, which can be

considered a kind of laughter (see video at <https://www.youtube.com/watch?v=j-admRGFVNM>; Panksepp and Burgdorff, 2003). Tickling evokes laughter in all the great apes, humans, chimpanzees, bonobos, gorillas and orangutans (Davila Ross *et al.*, 2009). Laughter in humans may well be evolutionarily continuous with tickle-induced vocalizations in the other great apes (Davila Ross *et al.*, 2009).

***Why can we not tickle ourselves?*** It has been a puzzle as to why we cannot tickle ourselves. The prevailing theory is that when the tickling sensations are predictable, they don't evoke laughter or the gargalesis responses: in other words, it is the unpredictable quality of tickling that evokes our intense response to it. (The reader can easily confirm this by rhythmically poking a finger at themselves; most of us remain untickled, even in 'ticklish' areas.) When we attempt to tickle ourselves, our outgoing motor commands are associated with predictions of motor action, which prospectively cancel the tickling sensations (Blakemore *et al.*, 1999; Chambon and Haggard, 2013).

To test this idea, we can create experimental conditions to allow for self-tickling. For instance, self-tickling becomes possible when a time delay is imposed between the initiated action and the perception of tickling or when the spatial disparity between the actions initiated and the actions delivered to the skin is increased (Blakemore *et al.*, 1999). Strikingly, Blakemore and colleagues (2000) found that people with symptoms of schizophrenia did not discriminate between self- and other-initiated tickle under these experimental conditions, which is consistent with their difficulty in assigning a locus of agency. If a person cannot distinguish who is initiating a tickle, the self or someone else, then self-tickling becomes possible. Thus, the inability to tickle oneself, coupled with our capacities both for being tickled and for tickling others, is an example of the discrimination our brain makes between 'self' and 'other' (Figure 2).

***What is the self?*** Typically, we think of knowing our ‘self’ as a type of metacognition — being aware that we are aware. We typically assess the development of the sense of self in humans and great apes by testing whether an individual can pass the mark-and-mirror test (for example, Bard *et al.*, 2006). This means that, when we look into the mirror and see a coloured mark alongside our nose, for instance, when we attempt to remove it we touch the mark on our own face, and not the mirror image. Children typically pass this mark-and-mirror test around 18–24 months of age, although there is cultural variation, and laboratory-housed chimpanzees pass the mark test at about 28 months.

***Do other animals have a sense of self?*** Yes: great apes, dolphins, elephants, and magpies pass some form of the mark-and-mirror test (reviewed by Suddendorf and Butler, 2013), demonstrating that they have a sense of self that is very similar to that of young human children. Mirror self-recognition is a visually based discrimination of the self, and this has a limited distribution among animals, but clearly animals do distinguish self from other in touch. (If the reader doubts this, sneak up on a sleeping cat and lightly tickle it — if a startle response is elicited, then the cat is discriminating self-generated touch from other-generated touch.) While it remains a puzzle why so few animals recognize themselves in mirrors (visually), nevertheless, many animals clearly do recognize foreign activity at their skins (cutaneously). Interestingly, only humans and the other great apes have been reported to display the triad of mirror self-recognition, frequent tickling of others, and laughter while being tickled. It would be a profitable avenue of future research to investigate whether these activities implicate a quality of social engagement (known as *intersubjectivity*) not present in other animals. Thus, shared laughter, combined with a sense of self, might form the basis of a special, joyful quality of intersubjective engagement.

*Where can I find out more?*

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Figure 1. Tickling in great apes.

Top row: conspecific tickling. Jengo, an infant gorilla (left) and an infant chimpanzee (right) display obvious joy in being tickled by conspecifics. Currently, there are few reports of active tickling in animals, outside the great apes; this is an area requiring further study. Bottom row: heterospecific tickling: Joni (left) and Lucas (right) laughing while being tickled by humans. Although not fully visible in this photograph, Lucas is displaying a tickle-solicit, indicating

the base of his own neck with his index fingers. Photo credits: top left: photograph of Jengo-- Associated Press; top right: mother and infant chimpanzee (J. Schneider, reproduced with permission from Bard, 2002); bottom left: Photograph of Joni being tickled by N. Ladygina-Kohts (Ladygina-Kohts, 2002); bottom right: Photograph of Lucas successfully soliciting a tickle from Kathy Gardner Hayes (E. Ferrelli, reproduced with permission from Bard, 2008).

Figure 2. Simplified, speculative schematic of the experience of tickling.

The ascending sensory tracts carry different qualities of skin sensation: the dorsal column delivers fine touch, the lateral spinothalamic carries pain and itch, and the anterior spinothalamic transmits deep touch. According to the hypothesis described by Seldon (2004), simultaneous stimulation of the dorsal column and the lateral spinothalamic induces knisemesis, whereas simultaneous stimulation of the lateral and anterior spinothalamic columns induces gargalesis. However, whether the sensations are perceived as tickling or not depends on whether the touch is self-generated or other-generated (Blakemore *et al.*, 1999); this is depicted in this figure as a comparison of a predictive efferent copy and the actual sensory information. Although the outcome of this comparison is dichotomously depicted here as attributable to the self or not, actually there are degrees of ‘selfness’. If this hypothetical mechanism is correct, then any animal that can be tickled may be displaying a sense of self.

In Brief:

A quick guide to tickling, a form of laughter-evoking play that can be considered as an index of agency, with a discussion of its taxonomic distribution and its possible relationship to traditional measures of self-recognition.

