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Jacquelyn H. Flaskerud PhD, RN, FAAN

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CULTURAL COMPETENCE COLUMN

Yawning, Why and When?

Jacquelyn H. Flaskerud, PhD, RN, FAAN

University of California, School of Nursing, Los Angeles, California, USA

Edited by

Jacquelyn H. Flaskerud, PhD, RN, FAAN

University of California, School of Nursing, Los Angeles, California, USA

A study about yawning and psychopaths caught my attention recently (Rundle, Vaughn, & Stanford, 2015). The word “psychopath” is what drew my interest first. An acquaintance had recently been subjected to a 5 1/2 month “visit” from a family member that he couldn’t get to move out. This person used manipulation, charm, lies, an inflated ego, a lack of remorse, and a callous indifference to his effect on other people to extend his stay. The label “sociopath” came to my mind when I heard about it. Neither the term “psychopath” or “sociopath” appears in the DSM-5 (American Psychiatric Association, 2013); rather both labels are subsumed under Antisocial Personality Disorder. For some, the terms are used interchangeably and there is little difference ascribed to the two types of personality disorders. However, scholars in the neuroscience and psychiatry disciplines differentiate between the two (Pemment, 2013; Roberts, 2013) with psychopathy considered to be an innate condition of the individual whereas sociopathy implies that environmental factors, such as upbringing, have played a role in its development. Psychopaths and sociopaths can differ in impulsivity, social relationships, criminal tendency, and predisposition to violence. A key difference is that psychopathy infers that the individual will have no empathy or sense of morality, whereas sociopathy is indicative of having a sense of empathy and morality but the sense of right and wrong is not that of the parent culture (Pemment, 2013). (For an in-depth discussion of differences, including neuroanatomical and psychophysiological dysfunction, see Pemment, 2013). In the Rundle et al. (2015) study, although the word “psychopath” caught my attention, what intrigued me was the suggestion of its relationship to yawning.

Researchers studying contagious yawning—yawning when others yawn or after seeing a picture of someone yawning—have

noted that it has been linked to empathy—the ability to understand and connect with others’ emotional states (Bartholomew & Cirulli, 2014; Rundle et al., 2015). Contagious yawning frequency is related to how close the social bond is to the person yawning. It occurs most frequently with kin, then friends, then acquaintances, and then strangers at a decreasing rate. The key absence of empathy in psychopathy has led investigators to study the relationship of contagious yawning to psychopathic characteristics (Rundle et al., 2015). These researchers asked 135 students to fill out a questionnaire called the Psychopathic Personality Inventory-Revised (PPI-R), which is a set of questions used to diagnose psychopathy by identifying personality traits such as cold-heartedness, Machiavellianism, egocentricity, callousness, and impulsivity. Then, the students viewed videos of people making different facial movements, including yawning. As hypothesized, the researchers found that those who had more psychopathic tendencies were less likely to yawn when they viewed the yawning clip. They found that scores on the PPI-R subscale “cold-heartedness” significantly predicted a reduced chance of yawning. Rundle and colleagues (2015) concluded that these data suggest that psychopathic traits may be related to the empathic nature of contagious yawning in our species.

WHY DO WE YAWN?

The science of yawning has an interesting history. According to Walusinski (2010b), the first medical writings on yawning were by Hippocrates in 400 BC. He observed that yawning releases accumulated air and heat in the body—when the body temperature rises, hot air is expelled violently through the mouth. The explanation of yawning as a prodrome of febrile states continued into the seventeenth century and was thought to help evacuate harmful vapors. Later the function of yawning was expanded to include accelerating all the body humors through the vessels and distributing them equitably so that the sensory organs and muscles could perform their functions (Walusinski, 2010b). In the eighteenth century came the idea that yawning improves brain oxygenation; this idea would persist for two centuries—into the twentieth century. In the nineteenth century, yawning was seen as a ventilator function—lifting the thorax muscles—that could accompany boredom, fatigue, exposure to

Address correspondence to Jacquelyn H. Flaskerud, University of California—Los Angeles, School of Nursing, 700 Tiverton Ave., Factor Building, Box 951702, Los Angeles, CA 90095-1702, USA. E-mail: jflasker@earthlink.net

cold, or any number of pathological states, both physical and mental (hysteria) (Walusinski, 2010b). By the end of the nineteenth century came the idea that yawning was a reflex—an involuntary act—but still required by a degree of anoxemia, a need for oxygenation of the nervous centers. Different explanations took precedence during the twentieth century, including a continuation of ventilation theory: a neuromuscular theory in which yawning has an origin in the diencephalon and the brainstem, and the view that yawning is a behavioral response to transient hyperthermia, acting to counter intermittent increases in brain temperature and promote thermal homeostasis (Massen, Dusch, Eldokar, & Gallup, 2014; Walusinski, 2010b). At the beginning of the twenty-first century, the neurohormonal mechanisms involved in yawning appeared to be established, making it a marker of activity in D3 dopamine receptors. Some see yawning as a mechanism for stimulating wakefulness or arousal while others contest this view and instead link yawning to sleepiness.

Modern neuromedicine is still looking for a complete explanation of yawning, however the cultural views of yawning provide interesting beliefs related to the meaning of yawning. In sixth century in Europe there was a belief that the soul left one's body during a yawn or sneeze and to counteract this, a person should make the sign of the cross before his or her mouth (Walusinski, 2010c). In nineteenth century Europe there was some support for the notion that yawning was associated with having limited intelligence, no initiative, a slow and lazy mind, and a weak and boring character (Walusinski, 2010c). It still often is associated with boredom, fatigue, and sleepiness in the Western world. In Arab countries, yawning has been seen as a sign of Satan entering the body and sneezing as a sign of him leaving the body. Putting one's hand or a piece of cloth or other object over the mouth could prevent Satan's entry. In India bhuts (spirits) enter the body through the mouth making yawning dangerous; the recommended practice is to put a hand in front of the mouth or snap one's fingers to scare away bad spirits. In ancient Mayan civilization, yawning was linked with boredom and with eroticism and passion (Walusinski, 2010c). A similar belief about yawning in more modern times is found in Italy where yawning is thought to express a variety of things, including the need for physical love, hunger, and thirst (Walusinski, 2010b, p 16).

WHEN DO WE YAWN?

A more reliable clue to the meaning of yawning might come from when we yawn. Spontaneous yawning is present in humans across the life span, beginning in fetuses, and is apparently linked to sleep-wake transitions and, perhaps, the modulation of arousal processes or enhancing vigilance levels (Konnikova, 2014; Provine, 2005). Yawning is associated with feeling subjectively sleepy. People report yawning more frequently when they are feeling tired. This differs, depending on age, with the frequency changing over the life span, as the sleep-wake pat-

tern stabilizes. People are especially prone to yawning in the hour immediately after waking, associated often with stretching, and the hour preceding their usual bedtimes. Yawning also increases with hunger and with boredom (Konnikova, 2014; Provine, 2005). Boredom, hunger, fatigue: These are all states in which we may find our attention drifting and our focus becoming more and more difficult to maintain. A yawn, then, may serve as a signal for our bodies to perk up, a way of making sure we stay alert. Provine (2005) believes that a yawn may simply signal a change of physiological state, a way to help our mind and body transition from one behavioral state to another—sleep to wakefulness, wakefulness to sleep, anxiety to calm, boredom to alertness. However, several studies have tested the arousal theory prediction by investigating spectral EEG changes and markers of automatic activity after yawns and have found no arousal effect using these indicators (Guggisberg, Mathis, Schneider, & Hess, 2010).

As noted earlier, in addition to being spontaneous, yawning also is contagious and occurs when viewing or listening to someone else yawning (try to read this without yawning). It is observed later (from four to five years of age and onward) than spontaneous yawning. This difference seems to suggest that it is independent of the propensity to yawn spontaneously and that the two have different underlying factors. Even thinking about yawning can induce it within 30 minutes in 88% of subjects (Provine, 2005). In contrast to the lack of direct empirical evidence for an arousing effect of yawning, an increasing number of studies have accumulated evidence for an important social function, at least in humans (Guggisberg et al., 2010). Yawning has a strong contagious effect in humans and primates, making the case that it is related to environmental conditions, both social and physical. Yawning may be a non-verbal form of communication that helps synchronize the behavior within groups (Guggisberg et al., 2010).

ANIMAL STUDIES

Investigators involved in animal studies have come up with similar and additional explanations for yawning. In a study of geladas, an Old World monkey species, Leone, Ferrari, and Palagi (2014) proposed that yawns have different functions depending on the intensity and social context. Three main theories of yawning were proposed: yawning as a response to rest-activity patterns; yawning as a threat behavior or conversely to connote a relaxed predisposition; and yawning as an arousal process. They tested three main hypotheses: If yawning is associated with particular patterns of rest-activity, indicating the possibility of an endogenous temporal rhythm (described in the literature as true yawns), they expected to find peak levels of this behavior in the early morning and late evening (Prediction 1). If yawning, especially in its more intense version, in geladas has a role in threatening, they expected that sex and rank would have an influence on the yawning frequency (Pre-

diction 2a). More specifically, they expected the intense form to be more frequently displayed during contexts of high social tension, such as during aggressive and competitive interactions (Prediction 2b), which, in geladas, are mainly entered into by alpha males. Conversely, if yawning is linked to a relaxed predisposition to interact socially and positively, as suggested in other reports, they expected that these two patterns of yawns would be mainly performed by high ranking subjects, both males and females, as a form of appeasement (Prediction 2c), and that they would be temporally associated with reassuring signals such as lip smacking, which is frequently performed along with affiliative and parental care behaviors (e.g., grooming, body contact, play, lactating) (Prediction 2d). If yawning is related to general physiological arousal, they expected an increase in scratching levels (a reliable indicator of arousal in primates) immediately after a yawning event (Prediction 3) (Leone et al., 2014).

The findings (Leone et al., 2014) according to each prediction: (Prediction 1) As it occurs in other primate species, yawning showed predictable daily variations in geladas; animals yawned preferentially in the phase of sleep-awake transition, especially in the early mornings (Prediction 2a-2d); Clearly emerging from the data was the role of social factors on yawn distribution, and the relationship between male dominance rank and yawns of a higher intensity level. The less intense forms of yawning were linked to more positive social contacts and were commonly used by gelada females as part of a complex communicative system among individuals that often engage in affiliative interactions and that are emotionally connected; and (Prediction 3) With respect to arousal, their data showed that scratching increased after each yawning type, and more so after yawns of higher intensity level, suggesting that intense yawns could indicate an even higher level of arousal. The investigators concluded that their data seemed to indicate that yawns of different intensity have multiple communicative functions (e.g., synchronization of group activity, emotional connection, inter-group communication and threatening behavior) and that, in geladas, the spectrum of yawn intensity varies according to the sex of the yawner, with a strong gender difference that could reflect, at least in part, on the potential communicative functions of yawning (Leone et al., 2014). The sleep-wake transition and the arousal process have been investigated in humans also, but the threat/male dominance explanation of yawning has not.

Reports of yawning in animals include those in primates, dogs, horses, lions, birds, and more. Most of these deal with spontaneous yawning; but what about contagious yawning in animals? Although they did not address contagious yawning directly, the study by Leone and colleagues (2014) suggests a strong social context and communicative function for yawning. Senju (2010) reviewed the studies of contagious yawning in non-human animals and found that human yawns will elicit yawning in primates and dogs. In addition numerous anecdotes about contagious yawning in cats, horses, parrots, and blackbirds have

been reported after the study of contagious yawning in dogs was reported (Senju, 2010).

YAWNING AND MORBIDITY

The susceptibility to contagious yawning correlates with social skills and is reduced in persons with disorders affecting the ability of social interaction, such as autism spectrum disorder and schizophrenia (Senju, 2010). As noted at the start of this column, the absence of contagious yawning also has been related to the morbidity known as psychopathic disorder (Rundle et al., 2015). Certain extrapyramidal syndromes are associated with the disappearance of yawning, such as treatment with neuroleptics and Parkinson's disease (Walusinski, 2010a). However, numerous medications used in neurology and psychiatry lead to an increase in the frequency of yawning. Repeated yawning could form part of a tic disorder. Excessive yawning occurs in many other situations, the most common being sleep deficit. Additionally, dyspepsia (the sensation of a full stomach), slow digestion, and an irritable colon often are associated with a succession of yawns. Detoxification in heavy coffee drinkers or users of opiates is accompanied by a withdrawal syndrome that includes the occurrence of repetitive yawning over several days. Migraines, a common disorder in humans, sometimes end with repeated yawning, accompanied by drowsiness and a postdrome profile (Walusinski, 2010a). During the course of a stroke, yawning occurs in several stages. The presence of yawning is seen in coma and in the affected limb in hemiplegia—when the patient yawns, the paralyzed arm moves the hand up to the mouth. In some forms of stroke, yawning and repetitive facial expressions signal the dissociation of the automatic and voluntary pathways (Walusinski, 2010a). Yawning occurs with epileptic seizures. Scratching the face, rubbing the nose, yawning, and sighing have been described as automatic behaviors that occur before or after absence seizures or focal seizures (Walusinski, 2010a). Yawning can trigger a disorder (e.g., mandibular subluxation) or relieve a disorder (e.g., restore hearing during a rapid descent in flight).

Finally, getting back to yawning, empathy, and yawning's relationship to psychopathy, there are several investigators who confirm the relationship between contagious yawning and empathy (Guggisberg et al., 2010; Leone et al., 2014; Provine, 2005; Rundle et al., 2015; Senju, 2010). Rundle and colleagues (2015) proposed that since contagious yawning is related to empathy, and psychopaths are characterized by a lack of empathy, then psychopaths would be more immune to contagious yawning. In their study, they demonstrated this relationship. Although Bartholomew and Cirulli (2014) did not study the susceptibility to yawning in persons with psychopathic traits, they did question the relationship of contagious yawning to empathy. In their study, 328 participants were administered a three-minute yawning video stimulus, a cognitive battery, and a comprehensive questionnaire that included measures of empathy, emotional

contagion, circadian energy rhythms, and sleepiness. Their results revealed that variables like empathy, tiredness, and circadian preference had little effect on contagious yawning susceptibility and that the contagious yawning response of individuals was stable over a two-month retest period, whether they were tested in the lab, or off-site via an online test. The age of the participant was the only variable with a significant influence on whether he or she yawned. However, age was able to explain only 8% of the variation in the yawning response, leaving the majority of variation unexplained by any known factor. They concluded that this extensive, unexplained, and highly replicable variation between individuals in their susceptibility to yawning suggests the existence of an underlying genetic influence and warrants future studies that assess the inheritance of this unique trait. (Bartholomew & Cirulli, 2014).

WHY? WHO KNOWS?

After reviewing all the evidence, Guggisberg and colleagues (2010) determined that despite progress in yawning research, it remains insufficiently understood to establish a generally accepted model of the origin and purpose of yawning. They noted that more data are needed on the neural and pharmacological processes that precede, accompany, and follow yawns. With respect to social (contagious) yawns, they recommended that future research should address the anatomical connections and functional interactions between social cortical networks and the centers that are responsible for yawning control.

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