

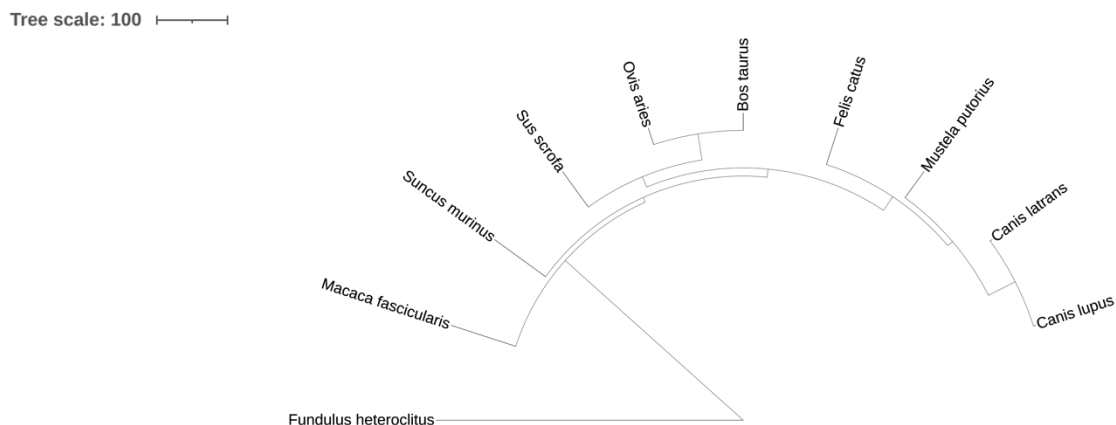
TINBERGEAN ANALYSES

A. Mechanistic Explanation: Vomiting is a physical event of the forceful expulsion of intestinal and gastric contents through mouth having several causes (Zhong et al., 2021). Even though the events that cause vomiting can be several, the control mechanism that accompanies these events is central. In brainstem, there are structures that are responsible for vomiting control: bilateral vomition centers that are in reticular formation of medulla. They intake signals from many sources such as chemoreceptor trigger zone, visceral afferents from the gastrointestinal tract, visceral afferents from outside the gastrointestinal tract, and afferent from the extramedullary centers in the brain. When the centers are stimulated, ultimately vomition is triggered. The chemoreceptor trigger zone – bilateral set of centers in brainstem – are not electrically stimulated causing vomiting. Instead, they work as emetic chemoreceptors for vomition centers: when a chemical abnormality in the body is sensed by these centers, they send excitatory signs to vomition centers causing vomiting. Also, the visceral afferents from the gastrointestinal tract inform brain in the cases of gastrointestinal distention and mucosal irritation to cause vomition; visceral afferents from outside the gastrointestinal tract inform brain signals from bile ducts, peritoneum, heart and many other organs causing vomition; afferents from extramedullary centers in the brain inform brain with psychic stimuli such as odors, vestibular disturbances such as motion sickness and cerebral trauma resulting in vomition (Bowen, 2019).

Then, the information receiving end – the vomition center – acts with phrenic nerve to the diaphragm, spinal nerves to abdominal and intercostal muscles, efferent visceral autonomic fibres to gut, and the viscera efferent fibres to parts of the voluntary muscles of the pharynx and larynx. Two phases occur: pre-ejection phase in which relaxation of gastric muscles occurs. Then, small intestinal retrograde peristalsis occurs. Later, ejection phase in which vomiting including expulsion of gastric contents takes place (Nausea and Vomiting, 2005).

Developmental Explanation: Vomiting can occur in different phases of life more occasionally than other phases such as new-born phase, childhood, and pregnancy. In new-born phase and childhood, common causes of vomiting are several: gastroenteritis because it is common in children causing vomiting; food allergies because mostly children's allergies are not known until their initial symptoms are seen; poisons because children can accidentally try to swallow something poisonous. Also, as a congenital problem, congenital pyloric stenosis – condition present at birth in which narrowing of the passage from the stomach to the bowel causing food pass unable resulting in projectile vomiting – is a vomiting cause that initiates on birth (Vomiting in children, 2021). In the case of pregnancy, vomiting mostly occurs in the first three months of the pregnancy due to the elevated hormone levels (Nausea and Vomiting, 2005).

Phylogeny:



Adaptive Hypotheses: Cats, *Felis catus*, lick themselves for several reasons – this action is named grooming and mostly done for hygiene. Grooming keeps cats' fur brushed, trimmed, at healthy length, and away from mats. Yet, while they lick their fur, naturally, they can get wads of fur stuck in their stomach that has the chance to cause intestinal blockage (What to Do, 2020). When intestinal blockage occurs, it causes restriction of nutrient and other substances' flow which in return creates pain, and even necrotic – dead – tissue that can possibly affect the survival of the cat (How To Spot, 2020). Therefore, vomiting is adaptive in cats, *Felis catus*, because it helps them to extract the wads of fur that they can possibly have from grooming; the

fur that are stuck in their intestines causing blockage, so causing lack of nutrition flow possibly resulting in necrotic tissue.

Dogs, *Canis lupus*, like many other domestic animals, can encounter toxins and eat them. When they ingest toxins, sometimes, their smell and taste gatekeepers are not always effective in detecting the quality of the food they have ingested (Horn, 2008). Fortunately, one additional mechanism plays an adaptive role in survival of the dog: vomiting. Dogs, to extract the toxins that they ingested – these toxins have the possibility to cause gastrointestinal problems, internal bleeding, kidney failure, liver failure, and eventually death (Howard, 2020) – vomit as a defense mechanism. Therefore, it can be said that vomiting is adaptive in dogs, *Canis lupus*, because it helps them to get rid of the toxins – the toxins that can possibly end dogs' life – that they ingested and aid in the survival of the species.

Possible Experiments for Above Adaptive Hypotheses: To test the adaptive hypothesis of vomiting in cats, a lab study can be conducted. A group of total 30 cats can be used. Half of the cats (15) would be the unaltered, natural cats – the control group - and the other half (15) would be, by drug, altered cats that are unable to vomit due to changes in their nervous system. In lab, these cats can be kept in an artificially natural environment for 6 months – the time is specially long to be able to observe any long-term effects. After 6 months, the cats can be clinically examined to see if there are any differences between the neurologically altered cats and normal, unaltered, cats. Specifically, the gastrointestinal tract could be examined thoroughly to see if there are any possible causes of pain to the altered cats, and some necrotic, dead, tissue affecting the functionality of the gastrointestinal tract in them. After the clinical examination, in the sense of statistical significance, if problems causing pain and non-functionality in gastrointestinal tracts of neurologically altered cats are seen to threat the cats' survival, and if there are no significant problems causing any pain and non-functionality in normal, unaltered group, it can be deduced that the vomiting of wads of fur that originates from self-grooming is

adaptive for cats because it increases their chance of survival, and natural ability of their organs to function.

To test the adaptive hypothesis of vomiting in dogs, a lab study can be conducted. There can be a total of 30 dogs, half as the unaltered group – normal dogs that are not altered by a drug - and the other half as the manipulated group – that are altered by drug. This drug alters the neurochemistry of dogs' ability to vomit. After the administration of the drug causing inability to vomit to the manipulated group, all the dogs can be given a toxic chemical that affects them chemically to vomit and damage them mildly, not severely; this material can be given by being put in one of the dogs' meals. Also, this chemical should be chemical that is not detected by dogs as dangerous when it is tasted and smelled, too. After this toxic material is ingested by dogs, a sufficient amount of time can be used to observe dogs and compare the unaltered and manipulated groups. Later the dogs can be clinically examined to find out if the toxic material have affected the manipulated group, the group that is unable to vomit, more when compared to the unaltered group, the group that is able to vomit and try to get rid of the substance. If it is found with statistical significance that the unaltered group has less health issues – these health issues are measured by evaluating the functional ability of gastrointestinal tract, heart, kidney, and liver – when compared to the manipulated group, it can be deduced that vomiting is adaptive for dogs, *Canis lupus*, because it helps them to get rid of the toxins – the toxins that can possibly end their survival – that they ingested.

B. Adaptive Hypotheses Offered in The Paper: The paper observes copulations of Indian flying fox colony, *Pteropus giganteus*, under natural conditions, specifically emphasizing on the observed cunnilingus – male licking female's vagina - and its possible adaptive perspective on flying foxes. According to the Maruthupandian and Marimuthu (2013), there is one distinct adaptive function of cunnilingus that is related to sperm competition: Cunnilingus before copulation can be used by males to lick sperm – the sperm that can be possibly left on/in female's vagina from previous copulations - from the female's vagina to increase the chance of

their own sperm being more in/on female's vagina to achieve a higher rate of possibility that the offspring that can be fertilized belongs to the male who have acted the cunnilingus (Maruthupandian et al., 2013).

To test adaptive hypothesis, a long-term observational lab study can be conducted. In this study, the Indian flying foxes, *Pteropus giganteus*, can be observed in a lab where their natural environment is artificially created. The sample size of this study should be high, such as 100-200, because there is no modified behavior: the copulation type and presence of cunnilingus is a matter of flying foxes' own behavior. The time for which this experiment takes place can be decided according to the flying foxes' most sexually active times of the year. After these times are deduced, just before those phases, foxes can be taken from nature and introduced into the artificially created natural environments. In these environments, there can be cameras used to observe and record their copulatory behavior. After the time phase of sexual activity diminishes, the foxes that have had multiple partners, but the last partner with cunnilingus can be compared to foxes that have had the same multiple partners without cunnilingus, especially the last one without cunnilingus; these bats can be detected from the cameras that are implemented in the artificial environment. For this comparison to happen in a better way, there should be less females and more males present in the flying fox population, too. In this process, genetic comparison should be used. It should be checked if the female foxes that had copulation with cunnilingus-active male foxes have the fertilized offspring with genes of the cunnilingus-active male foxes that they have copulated. This same process should be done for the other group, too; the group in which female foxes have had same multiple partners, but the last with no cunnilingus. After these data is found and the comparison is made, if it is seen that the female foxes' offspring having the genetics of the male foxes that the females have had cunnilingus with at the last copulation is higher than the female foxes' offspring having the genetics of the male foxes that the females haven't had cunnilingus with at the last copulation, it can be concluded that cunnilingus aids in the sperm competition. Therefore, it can be said that cunnilingus, before copulation, increase the

cunnilingus-doing male's sperm being more in/on female's vagina to achieve a higher rate of possibility that the offspring that can be fertilized belongs to the male who have acted the cunnilingus (Maruthupandian et al., 2013).

ESSAY:**Sometimes Willpower Is Not Enough to Challenge Obesity**

Obesity is a disease which involves excess amount of body fat that increases risk of other diseases and health problems (Obesity). This disease is known to be present in humans, yet it is not widely known that animals can be obese, too. Obesity in animals can cause problems such as diabetes, cardiovascular problems, musculoskeletal disorders, and even death in some instances (Horowitz, 2012). For a very long time, it was thought that obesity's cause was the "calories in – calories out" theory: if the number of calories that is taken in within a day is higher than the amount that is lost, then weight is gained; when people couldn't lose weight, they were blamed that they didn't have the willpower to take less calories than they lost in a day (Horowitz, 2012). Later, also by Richard Jackson, it was stated that "Obesity is a disease of the environment". This meant that "calories in – calories out" theory wasn't completely true. In this essay, the situations causing obesity against the willpower of people trying to lose weight and get rid of obesity, are discussed in three categories: evolution, biology, and psychology.

In this paragraph, obesity from evolutionary perspective is discussed. Animals, in wild, can encounter famines or lack of food. Therefore, as a basic survival mechanism, when they found food, they eat excessively; yet, to find the food they eat, there are challenges that they need to overcome which in return helps them to be physically active (Horowitz, 2012). However, because, nowadays, many animals are domesticated, the food they eat is "prepped" by people, and they access to this food without facing any challenge; due to their evolutionary past, they eat excessively, but they lack physical activity that puts them in a healthy, balanced lifestyle. Thus, they become unhealthy, fat restorative, animals. This excessive eating causing obesity is not only unique to animals, but also abundant in humans, too. Because humans have sugary, fatty, accessible, and cheap food, it is very easy to eat unhealthy food without any physically healthy activity and lifestyle. Thus, obesity becomes easily achievable (Horowitz, 2012).

In this paragraph, obesity from biological perspective is discussed. Biologically, several situations can affect obesity that develops regardless of willpower: addictive-like behaviors, circadian rhythms, drugs, microbiomes, hypometabolism and thyroid disorders. Excess sugar, fat, and salt can alter brain chemistry – mostly with increased dopamine stimulation related to reward system (Xian & Wang, 2020) - causing induced appetite drive resulting in a situation in which it is nearly impossible to resist fattening, obesity causing, foods containing sugar, fat, and salt (Horowitz, 2012). Circadian rhythm is a 24-hour body clock – mostly 8 hours sleep, 16 hours awake, a sleep cycle - for our bodies to regulate hunger, appetite, ingestion, and even digestion (Horowitz, 2012). It can cause weight gain, too. It is controlled by complex brain mechanisms in which light from environment is used as a compass to regulate the 24-hour clocks' mechanism. If, the sleep cycle in circadian rhythm is disturbed by manipulated light exposure, it can affect weight gain, not only in humans, but also in animals (Horowitz, 2012). Drugs can cause weight gain, too. It is not directly known, but it is considered that drugs can contribute to intestinal stretches leading to greater calorie absorption and weight gain (Horowitz, 2012). In the case of antibiotics, it is also thought that they can affect the gut flora, intestinal microbiome, causing disruption leading to weight gain (Horowitz, 2012). As told, microbiomes, the bacteria that are in intestines, can cause weight gain, too. Mainly, microbiome is divided into two: Firmicutes – absorbs more calories compared to Bacteroidetes - and Bacteroidetes. In obese people, Firmicutes in intestines is higher than Bacteroidetes causing higher calorie absorption from the ingested food leading to higher calorie intake, and eventually weight gain (Horowitz, 2012). Lastly, hypometabolism and thyroid disorders can disrupt metabolism creating obstacles for the body to create calorie gap even when it tries to decrease the number of calories it takes in (Chin, 2014).

In this paragraph, obesity from psychological perspective is discussed. Psychologically, people can be influenced to gain weight by having obese friends. People can be influenced by their obese friends' attitudes towards food causing them to gain weight (Horowitz, 2012). In addition, people who experience stress and trauma can either have lack of accessibility to healthy

life and food or can have disrupted binge-eating causing them to gain weight and become obese (Brewis, 2019).

In conclusion, it can be deduced that different evolutionary, biological, and psychological aspects from life can induce obesity and weight gain regardless of the willpower that people pose to challenge gaining weight.

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