Reflex and Instinct

A distinction between a reflex, which is an automatic response and an instinct, which is an autonomous response

By: Moshe Menasheof

A reflex is defined as a physiological reaction in a closed, mechanic stimulus-response system called a *reflex arc*. The reaction is automatic and does not involve the cerebrum. The word *reflex* is often used to describe reactions which do not fit the strict definition of a reflex, usually because they are immediate and unintentional. However, these characteristics are not enough to define a reaction as a reflex.

In this essay, Moshe Menasheof defines *instinct*, a reaction which, like reflex, can be immediate and involuntary, but unlike it is processed in the cerebrum. That is, an instinct is a reaction which originates in awareness. The instinctive reaction is only triggered when awareness identifies something to trigger it.

Another difference essential to the distinction between the two types of reactions is that reflexes do not change, while instincts do. The physiological mechanisms which activate instincts do not change, but the meanings that trigger them do, creating the appearance that instinctive reactions change during a person's life.

Using these definitions and the distinction between reflex and instinct, the author gives the readers tools to help them in analyzing different reactions and deciding whether an immediate, involuntary reaction is truly a

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reflex, or actually an instinct. The author points to a number of examples which are mistakenly called reflexes, such as the cold crying reflex, which is actually an instinctive response. The essay also gives examples of cases which can be both a reflex and an instinctive reaction, such as vomiting.

Both terms - reflex and instinct - refer to immediate reactions to outside stimuli. However, they are different from one another. The most important difference is that a reflex is an immediate reaction which does not involve awareness, while an instinct is an immediate reaction which does involve awareness. It can be defined in the following manner: a reflex is an automated response, while an instinct is an autonomous response. That is, an instinct is a system which reacts to autonomous rules, which is a rule onto itself, and which is not dependend on the central decision making system, which makes voluntary decisions.

Reflex

A reflex is defined as an immediate, automated and involuntary bodily response to a stimulus. Since a reflex response necessitates that appropriate muscles be activated, a reflex cannot be a chemical or physical response directly to the

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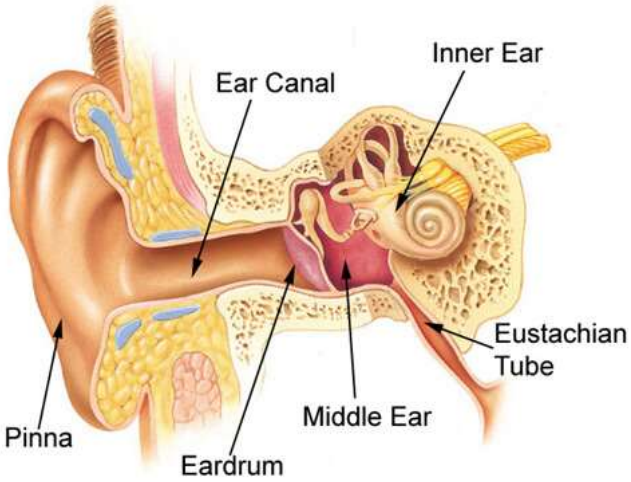
stimulus. That is, it cannot be a simple system of stimulus-reaction such as a chemical reaction.

Reflexes are meant to serve survival goals in humans and other animals. They allow a quick and automatic response to events which may endanger them or are essential to their function. There are many and varied reflexes. The most famous are the knee-jerk reflex, the pupillary light reflex, the vomiting reflex, the coughing reflex, the sneezing reflex, the corneal reflex, and the acoustic reflex. For each of them, we should examine whether they are really reflexes, and for that we must first discuss Pavlov.



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> **A*n acoustic reflex*** *is an involuntary reaction of certain muscles in the inner ear. It aids in protecting the inner ear from acoustic stimuli the intensity of which is too high. Muscles in the middle ear contract, thus reducing the vibrational energy which is received in the outer ear and passes from it to the inner ear.*

Any reflex has a sensory stimulus and a response, and the response usually involves the activation of muscles. Therefore, a reflex must be the result of neural processing. However, this processing happens outside of the cerebrum, through a pathway called the reflex arc. That is, reflex does not include a sensory perception - there is no processing of meaning in awareness. The response is immediate and happens even before the person has perceived the meaning of the neural signals the stimulus created in his awareness.

A reflex arc is a neural reaction pathway in which information is transfered from a sensory nerve to a motor nerve through a nerve in the spinal cord but without passing through the cerebrum. In the withdrawal reflex, for example, the neural impulse begins in the sensory neuron, passes through an inter-neuron in the spinal cord and on to a motor neuron, which contracts a muscle and pulls a

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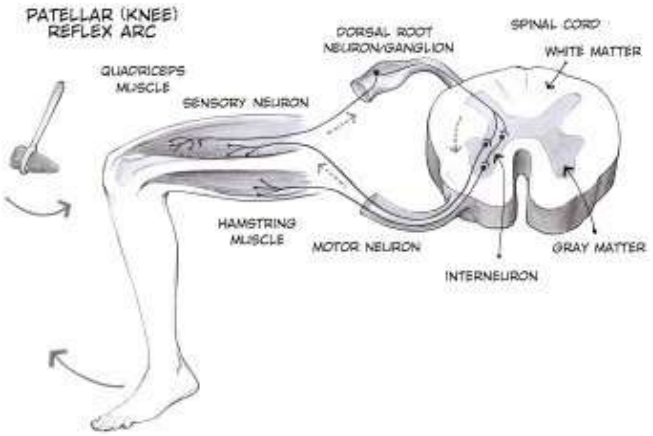
body part away from the source of stimulus. In other reflexes the response is according to the original stimulus.



the knee-jerk reflex

The purpose of a reflex is to shorten the neural pathway and allow for an immediate reaction in dangerous situations where it is needed. This reaction is automatic and always happens in the same manner. For example, each time the tendon below the kneecap is struck, the knee-jerk reflex will be activated. It will cause a muscle to contract and the leg to kick. If this reaction doesn't happen, it may be an indication of a problem in the connection between the sensory nerves and motor nerves connected to this reflex.

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From the fact that it is possible to examine the nervous system by using this reflex, we can deduce that it does not change with age. In the same way the pupillary reflex, and all other reflexes, do not change with age.

Distance is not What Shortens the Reflex's Reaction Time

Observing the knee-jerk reflex might give rise to the hypothesis that the reson the reflex arc does not include the brain is so that this will shorten the pathway, and therefore the reaction time. However, the distance of the stimulus from the brain is not an important factor in defining a reflex. That is, even though that for the knee-jerk reflex this hypothesis seems to make sense - the neural pathway goes through the spinal cord and not the brain in order to save time - the fact that the brain is far from the leg doesn't explain the reflex being an immediate and automatic response. The essential point is that the response is not triggered by a meaning in awareness. Just as the reflex arcs for the acoustic reflex or the pupillary reflex

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do not pass through awareness, even though in those cases the original stimuli are very near to the brain. A reaction in a pathway which passes through awareness takes longer than the reflex. This is why awareness of what has happened only comes after the motoric reflex response. The reflex response is primary and immediate, and information reaches awareness, is processed and assigned meaning at the same time with the reflex response. This is how it is possible that the person will notice that there is no threat immediately after the reflex response. That is, the information regarding what has happened has reached the cerebrum, entered awareness, the person has examined the various meanings related to the event and reached that conclusion. A different conclusion is of course also possible. For example, it could be that the person is in danger, and conscious decisions and actions are required to escape it.

If a person absentmindedly touched a sharp saw, a reflex response would cause him to immediately withdraw his hand, even before he could realize that it was in any danger. A moment later this fact would also come into

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his awareness and he would experience fear - his heart would beat strongly and he might even find it difficult to relax, since he realized he was in actual danger. In this case a reflex is activated, but at the same time information reaches awareness and causes fear. That is, it is completely possible that a reflex be activated and, at the same time, the person would also experience a certain emotion. A person who hears a lion roaring, for example, will first experience a reflex reaction as an immediate response, and then fear when he will understand that he might be facing a lion. Alternatively, he might realize the roar came from the soundtrack for a movie and he has nothing to fear.

Instinct

Instinct is also an immediate response of the body to a stimulus. Unlike reflex, however, the instinct is not an automatic response but an autonomous response to a meaning in awareness. The instinct is an innate immediate response. Like the reflex, the instinct is also a primary response, until the event reaches the person's awareness.

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However, in the case of an instinct it is not a closed, mechanic system, but an immediate and innate response to information which is given meaning in the person's awareness before processing the data and deciding according to it, and is therefore autonomous.

The instinctive response is activated by the identification of a danger or another element. This activates the instinctive mechanism in the inner brain. That is, the instinctive response originates in the cerebrum - the trigger is in the neo-cortex, which is considered to be the part which processes data, but the instinctive mechanism itself is probably in the inner brain.

The instinct operates through physiological mechanisms. Activating these mechanisms catalyzes the secretion of neurotransmitters. These affect the activity of neuro-motoric arrays which control the skeleton, speech, heart activity and so on. An instinctive reaction, therefore, can consist of increased bloodflow, yelling or pulling back.

An instinct is a mechanism which pushes the person or animal to immediate action in certain situations. For example, when they recognize they are in a dangerous situation. It is the mechanism which moves the baby to burst into crying when it feels some unpleasantness related to cold, hunger, pain and so on. The instinct usually

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creates the first push to action and may continue in concert with voluntary actions. For example, a baby which reacts to the unpleasant sensation of hunger by crying, may continue to cry even after it has had its fill, in order to attract attention. It is also possible that a person would act voluntarilly, according to consciouss decisions, but that their actions will still include instinctive impulses. For example, a child may cry because he is hungry, but after being fed would still want to continue and enjoy the pleasant taste of the food. The crying can also continue due to a reflex of playfulness or a competitive impulse, which pushes him to try and achieve more.

Instincts are classified as non-acquired behavioural responses. That is, they are innate, and we can assume that they are the response of evolutionary memory, passed on from generation to generation through the genes. We can assume that what is inherited is not the content the person is exposed to, but how physiological mechanisms are influenced by it. These influences can bring about physiological changes, which can be expressed in changes in the activity of physiological mechanisms, such as the secretion or regulation of neuro-transmitters (hormones).

There is also the possibility of inheriting changes in the triggers (meanings which activate specific physiological mechanisms) or their identification.

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Such changes will be expressed in the sensitivity as well as the identity of these triggers. The triggers, while being meanings in awareness, are also primary, innate meanings, which accompany acquired meanings. For example, the meaning of a pleasant feeling which accompanies the acquired taste of breast milk, or the meaning of the unpleasantness which accompanies the acquired meaning of hunger or an aching stomach. If the trigger meanings are innate, then they must be inherited in some way or another, and if they are inherited, one can assume that they undergo evolutionary changes.

In a person's systems of survival and protection, instincts give an immediate respons additional to that of reflexes. The immediate response gives an initial relief, until the person can gather and process data and reach a voluntary decision what to do. That is, instincts are response-systems which operate in an involuntary and autonomous manner; they are reactions to primary meanings (like primary sensory meanings) in awareness which have not yet been processed with other meanings around a common subject. That is, instinctive systems are activated even before the person has enough information on the event to allow them to consider and decide how to react.

This entire discussion is predicated on the presumption that a person acts according to their

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decisions, that a person decides according to the meanings in their awareness. Decision making processes in situations in which the instinctive systems have been activated will be emotional, and will generally be the first phases, in which feeling and emotions are reset.

Reflex or Instinct?

A reflex is an automated response to a sensory stimulus. An Instinct, on the other hand, is an array of innate response patterns to certain situations. These situations are also perceived by the senses, but unlike the way they are handled in reflexes, in instincts they are processed in the cerebrum. That is, an instinctive response is triggered following the identification of certain meanings which necessitate the activation of the appropriate instinctual system.

Instincts are also considered to be animalistic, non-cognitive responsed by the person, and are sometimes termed drives. In animals we can recognize various instinctive actions. For example, the calves of large mammals (such as cows, sheep, zebras, deer, donkeys, horses and so on) can stand, feed and even walk, all by an innate drive, or instinct. They do all this without immitation or previous knowledge.

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In order to ensure their survival, newly hatched turtles run towards the sea.

Researchers believe that noise from nearby roads or the lights of nearby cities can resemble the sound of waves or the look of moonlight glinting of the water, and confuse the young turtles, which then may not reach the sea before dawn.

Turtles can be said to have a reflex reaction to the sound of the waves or the moonlight glinting of them. This reaction is a physiological reaction to the noise of the sea. However, it can also be considered an innate instinct, since there are no

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fully grown turtles around when the eggs are hatched. However, the young turtles still leave their eggs and move towards the sea, probably following the sound of the waves. That is, the young turtles can process the situation and act instinctively according to the data. To a certain degree thay can even correct their course. If they were moved slightly off their course, they can shift direction towards the stimulus, whether it is the noise of the waves or the light glinting of them.

We assume that the turtles have perceived the sound of the sea and had an instinctive response to it, rather than a reflex one, since we are concerned with complex systems such as identifying and processing visual and auditory data, and identifying the correct direction according to them. This requires an integration of various systems, and it is therefore hard to assume that it is only a mechanical reflex reaction. Moreover, it is probable that the processing of data and coordination between various systems happen in the brains of the newly hatched turtles, and is therefore an innate property. That is, when these turtles hear the noise they do not respond to the stimuli by activating certain muscles, but there are automomous systems at play.

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Unlike animals which are born with varied abilities, such as mammals' ability to stand and walk immediately after being born, humans are born helpless. They have very little abilities, among them the ability to cry, suck (nurse) and grasp. Apart from these, they have to learn everything. It takes many months for a baby to learn first to sit and later to stand and walk. However, even newborns have similar abilities which are meant to ensure their survival.

In the same way that we explained the instinctive behavior of turtles, we can also explain a baby's behavior. The world reflex seems to be mistakenly applied to a variety of behaviors. Many of them, upon examination, are revealed to be innate instincts. For example, the so-called cold crying reflex:

> *The lungs of a fetus are non-functional and are full of amniotic fluid. Its heart also pumps blood from the placenta through the right side of the heart directly to the left, bypassing the lungs and the blood-vessels in them.*

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Upon birth, the umbilical vessels which had supplied the fetus with blood from his mother are closed off. The baby's lungs begin to function, an artery called the ductus arteriosus, which allowed blood to bypass the lungs, is closed and the holes between the right side of the baby's heart and its left, which allowed blood passage without going through the lungs, are also closed.

The blood starts flowing from the right side of the heart to the lungs. It creates pressure which forces the small arteries in the baby's lungs to open. In this stage the baby is ready to take its first breath and absorb oxygen into the blood stream through its lungs.

Crying helps the baby clear its lungs of excess amniotic fluid. It also increases

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blood flow to its lungs. The heart, which so far had been one unit, becomes a heart with two seperate atria and two seperate ventricles.

There is a common hypothesis that the baby cries in response to the exposure of its wet skin to the air. This response is called the cold crying reflex.

The main reason for the hypothesis that the cold crying reaction is a reflex is that the newborn baby cannot be thought to have any acquired knowledge. Therefore, the assumption is that it is a purely reactive physiological mechanism. This is reinforced by the fact that older children also cry when they are in pain, cold or are hungry, and even an adult recoils back from a sharp object. The fact that an adult does not usually cry as a response to stimuli which would have made them cry as a baby leads some to conclude that these reflexes change with age.

In most cases, the crying responses are involuntary. However, the very fact that the person does not decide to cry and cannot control their crying is not evidence that crying in general, and the baby's crying in particular, is a reflex reaction.

In many cases crying seems to be involuntary. For example, a child may cry because of pain and

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cannot stop crying even if it wants to; an adult may cry seemingly involuntarily in a moment of great excitement, or when seeing a very emotional movie.

The fact that we cannot hold ourselves back from crying and that we do not decide consciously to do so, are not evidence that the reaction is a reflex response. It is precisely in such cases that we realize that crying is a reaction to meanings in consciousness, because the person has to perceive that this is a sad or emotional event. Therefore, since such a perception happens in consciousness and processed in the cerebrum, the option of crying being a reflex response is eliminated. In other words, the cold crying response is not a reflex, and we can therefore deduce that it is an instinct.

A Reflex Doesn't Change - An Instict Does

A variety of physiological mechanisms tend to be innate and persist throughout the person's life. But some change and develop after birth, mainly in the first years of a person's life. For example, physiological changes in the airways or the skull.

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Many researchers consider the reactions of a newborn baby, such as crying, to be reflexes. They also claim that various reflexes change and disappear as the child grows, and integrate into more complex voluntary actions. On the other hand, some reflexes appear at a later age. Let's examine this claim.

According to the definition, reflexes are physiological mechanisms which operate automatically and do not change. Instinct are also physiological mechanisms which operate autonomously. However, the identification of the trigger - the meaning which activates the physiological mechanism of instinct, can change in accordance with the development of the person's awareness and the knowledge they gain.

A person is born with the instinct to react to what they find pleasant and to what they find unpleasant. They seek things which cause pleasantness and stay away from causes of pain or unpleasantness. An unpleasant sensation can be hunger, pain, itchiness, coldness or heat. A newborn can not tell these phenomena apart. They don't know what coldness or heat, pain or itchiness are.

A newborn baby doesn't know its own limbs, it can't know for certain whether the it feels pain or unpleasantness in its hand or in another part of its body because it has yet to map its body. Early

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in its life, a baby learns to map its various body parts, the entire surface of its skin, and so learns in which part of its body every stimulus takes place. It calibrates its body, so to speak.

As mentioned, a newborn baby cannot know whether it is cold or in pain or if it feels pain in its hand or in another body part. It can only recognize that it feels something unpleasant, and this knowledge, which is maybe one of the first meanings in its awareness, activates the instinctive mechanism which is ultimately expressed by crying. In this early phase crying is the principle response to any feeling of unpleasantness which may be caused by various reasons.

An instinct includes a trigger which activates the physiological mechanism. This trigger is a meaning in awareness. Usually these are innate primary meanings. These meanings come up as a reaction to certain stimuli or after exposure to certain contents, which imply danger, unpleasantness or maybe pleasure.

In every moment a person experiences something, his perception holds an image which is the sum total of meanings of the componenets of the experience. This cluster of meanings includes, for example, those received through neural signals; past knowledge related to the information, such as where the pain is, how long

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it lasts and whether it grows stronger or weaker, and information on time and space. Among all of these there may be important content which is used as trigger for an instinctive response.

Triggers are activated in the first phases of the experience or exposure to stimulus, when the person still does not have enough information on what is happening. Even in the first phase, of perceiving the stimulus, a cluster of meanings related to it develops. The meaning of the trigger, which activates instinctive mechanisms, can stand out in relation to the rest of the data. As long as there is just little data it has a large chance to stand out, but when there is a lot of data it will stand out or be overshadowed according to the type of information the person has. That is, a meaning which activates the trigger can be joined to other contents in the same cluster of meanings which creates the perceptual image, and continues to be part of the cluster of meanings even later.

For example, a baby cries because it feels some unpleasantness owing to being hungry or in pain in some part of its body. When its awareness develops, the child also experiences various kinds of unpleasantness and learns to tell them apart and how to react, according to circumstances. It also learns to identify the circumstances in which the pain is insignificant and passing and ignores

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it. A child which can already tell apart kinds of unpleasantness which arise out of hunger, coldness and pain will react differently in any situation. A grown person would not cry in situations which only cause mild unpleasantness, but may cry when they feel deep grief over some loss.

That is, even if stimuli are able to activate the trigger-meaning, it would not stand out of the other data a person has, and its effect would be lessened, or completely overshadowed. On the other hand, it is possible that some stimulus would be insignificant in itself (such as a child falling on his behind but only feeling little pain), but the circumstances would be such that the person realizes something unpleasant has happened (such as the people around reacting in alarm) and will therefore burst into tears. Instinct changes according to how much the cognitive meaning which triggers it stands out from other meanings in the cluster of meanings in awareness which are related to the event.

As mentioned, when a baby is born, its entire skin is wet, and when it is exposed to the air upon birth, the baby react to the coldness by crying. It is usually explained that two reflexes are activated by the fact that the skin is cooled - the cold crying reflex which causes the baby to cry, and the second, called the cold pressor reflex, which

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causes an elevated blood pressure in the baby's body.

The cold pressor reflex is indeed a reflex response which causes a change in blood pressure. The cold crying response, however is not a reflex but an instinctive response. It is not enough to say that the cold crying reflex continues to accompany the growing baby during the first months of its life and would cause it to cry, for example, when it has a wet diaper. The change in the intensity of the stimulus and the variety of responses to it according to circumstances are proof that it is an instinct rather than a reflex. It is a fact that what we call the cold crying reflex doesn't accompany the person throughout their lives. They would not cry whenever they feel unpleasantness because of coldness or wetness. It seems that the use of the word reflex when refering to this response shows a desire to bypass the problem rather than deal with it.

It is therefore doubtful whether other reactions often called reflexes, such as the nursing reflex or grasp reflex in babies, are indeed reflexes. They very well may be instincts.

In conclusion, an instinct is triggered as a response to a meaning in awareness. However, the identification of such meaning can change with the development of the person's awareness, and will therefore be different in every person.

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Some reactions are mistakenly refered to as reflexes. Reflex is not the result of a decision, but an immediate, involuntary response to sensory stimuli which happens in a pathway called the reflex arc. On the other hand, the instinct, which is also an immediate response and not a result of a considered and voluntary decision, involves an autonomous response to a primary meaning which flashes in awareness.

Therefore, the cold crying reaction cannot be a reflex, for the reason that reflex does not go through the cerebrum and through awareness, and therefore also cannot be a part of the development of awareness. The reflex response happens before meanings are weighed in awareness, and crying is usually the result of processsing and weighing information. Crying is one of the main human responses to situations of unpleasantnesss. It is an instinctive response shared by all people.

Additional Cases Considered Reflexes

We have thus far defined the two concepts - reflex and instinct - and explained the principle characteristics we can use to determine whether a certain phenomenon, reaction or behavior is a

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reflex reaction or an instinctive one. Having explained that the so called cold crying reflex is in fact an instinct, let us examine other cases which are often called reflexes, and see whether they really are that, or are they also instincts:

The **gag reflex** is a response which causes a person to vomit if certain sensitive parts of the mouth are irritated. Sensitivity changes as the person grows up. For babies the sensitive area is usually the front and center part of the tongue, while for adults it is in very internal parts of the palate. The vomit reaction is caused when the sensitive area is irritated, for example by a finger or foodstuff. The reaction is different, even among people of the same age. Some children, for example, can easily swallow pills, and some find it hard.

In the same way, a grown person can throw up as a reaction to touching very sensitive parts of their palate, or even at the sight of something they consider to be extremely nauseating. A person may also throw up as a result of strong emotions, or an ulcer or dizziness. Some throw up when standing on a boat being tossed by the waves. Some people are more sensitive, while others are less.

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The variety of conditions show that it is possible for a person to throw up because of some meaning in their awareness. The individuality and wide spectrum of reactions are enough to show that the vomit reaction is not a reflex. It may be an instinctive reaction meant to protect the person. The response to touch may be a reflex, but since the sensitive area changes with age, and the degree of sensitivity is different in different people, we can cast doubt on the notion that a vomit reaction is a reflex, even in those cases.

A person may react by vomiting either when their palate is touched or when seeing something they consider very distasteful. In one case it is a reflex, and in the other an instinct.

The pupillary reflex, like the knee-jerk reflex, is used in physiological examinations. It, too, does not change with age. This reflex is expressed in a change in the size of the pupil when exposed to light. This reaction can be a local chemical reaction, or a physical reaction in which the pupil constricts in reaction to light. It can be a reflex response, but is most probably not an instinct.

On the other hand, the **corneal response**, which is also called the blink reflex, seems to be more instinctual, especially when it is in response to an object coming close to the eye. The reaction does

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not depend on the amount of light the person is exposed to, but on the understanding that something is coming closer. That is, the response is activated by a meaning in awareness, and therefore must be instinctive. This reaction is also different from person to person. Some can control it in certain situations better than others.

A similar case is the **withdrawal reflex** which immediately withdraws the body from a source of danger - as when touching a very hot, or very sharp object. When a person touches something very sharp and does not see it or know what it is, we can say that the withdrawal response is a reflex. However, if a person sees a snake and recoils, they act on instinct rather than reflex. This is because in order to understand that the snake poses a danger, the person has to give meaning to what they see.

Other cases are known as primitive reflexes. The central characteristic of these cases is that they appear in babies in the first months of their lives.

The sucking reflex - every time something is put into the baby's mouth, it begins sucking.

Grasping reflex - any stimulus of the palm or the inner part of the baby's fingers will cause it to grasp the cause of the stimulus. This response is considered to be automatic and termed a reflex. It is further explained that a few months after

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birth, this "reflex" disappears and becomes a voluntary response.

Rooting reflex - when a baby's cheek is stroked, or the corners of its mouth touched, it responds by turning its head towards the side touched, as if searching for a nipple.

Stepping reflex - when a baby's heel touches a surface, it will react by putting one foot in front of the other, as if trying to walk.

Swimming reflex - when a baby is put face down in water, it reacts by kicking. Underwater the reaction is stronger.

All these, and others, appear in babies and disappear in the first months or years of a person's life. They also all require some kind of identification - which happens in awareness, or in the cerebrum - of some source to trigger the reaction. In light of these circumstances, we can correctly identify these responses as innate instincts rather than reflexes; instincts which were developed through evolution and are meant to aid a person's function until they are able to function voluntarily.

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