# Human Input/output - Touch & Movement

## Haptic Perception

Haptic Perception is the general term covering the various forms of perception based on touch.

Visual and auditory perception are associated with specialised organs (eyes, ears) grouped in a small area (around the head).

By contrast, haptic perception takes place all over the body, and the various parts of the body differ considerably in their response to pressure, etc..

There are three types of sensory receptor in the skin:

* *thermoreceptors* respond to heat and cold
* *mechanoreceptors* respond to pressure
* *nociceptors* respond to intense heat, pressure or pain

In computing applications, we are mostly concerned with mechanoreceptors.

Some areas of the body have more mechanoreceptors than others.

Mechanoreceptors are of two types:

* *rapidly-adapting mechanoreceptors* react to rapid changes in pressure, but do not respond to continuous pressure
* *slowly-adapting mechanoreceptors* respond to continuous pressure

Sensitivity is greatest when both types of mechanoreceptors are stimulated.

## Sensory Acuity

Sensory acuity is often measured using the *two-point test*.

This simply involves pressing two small points (e.g., sharpened pencil tips) against the body.

The two points are initially placed very close together, then moved further apart until it becomes possible to feel two distinct pressure points rather than one.

The smaller the distance at which both points can be detected, the greater the sensory acuity.

The fingers and thumbs have the greatest acuity.

The distance at which dual pressure-points can be distinguished on the fingers is typically around 10 times smaller than on other parts of the body, such as the arms.

Sensory acuity varies considerably among individuals.

It can be improved with training, within certain limits.

For example, blind people who read Braille generally have better sensory acuity than non-Braille readers.

However, certain medical conditions can lead to reduced sensory acuity.

## Kinaesthetic Feedback

Another aspect of haptic perception is *kinaesthetic feedback*.

Kinaesthetic receptors in our joints and muscles tell us where our limbs, fingers, etc., are relative to the rest of the body.

Kinaesthetic receptors are of three types:

* *rapidly-adapting kinaesthetic receptors* respond only to changes in the position of limbs, etc..
* *slowly-adapting kinaesthetic receptors* respond both to changes in position and static position of limbs, etc..
* *static receptors* respond only to static position of limbs, etc..

Kinaesthetic feedback is important in many rapid actions, e.g., typing or playing a musical instrument.

## Haptic Memory

As with auditory perception, we have a short-term sensory memory for haptic experience.

This is known as *haptic memory*.

It functions in a very similar way to the auditory store, i.e.:

* Haptic events are stored as they are experienced
* New experiences replace older ones in the memory, but...
* If no new haptic events are experienced, previous events remain in the store.

## Movement

Most actions in computer usage can be divided into several stages, e.g.:

* A stimulus is received through one of the sensory channels
* The brain processes the stimulus and generates a response
* The appropriate muscles move

The process can be roughly divided into two stages:

* reaction time
* movement time.

Reaction time is dependent on the sensory channel through which the stimulus is received.

* Approximately 150ms for an auditory signal
* Approximately 200ms for a visual signal
* Approximately 700ms for a tactile signal (pain)

Reaction time varies considerably - practice can reduce it, fatigue can increase it, etc..

Movement time varies with factors such as physical fitness, etc..

In computing, we are mainly concerned with movements of the hands in response to visual stimuli.

This can be modelled using Fitt's Law.